IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW
OF
APPLIED MYCOLOGY

VOL. XXII MAY 1943

TILLER (L. W.). **Controlling wilt in Winter Cole Pears.**—*Orchard. N.Z.*, xv, 4, p. 13, 1942.

In a test at Wellington, New Zealand, in which half of the 42 cases of Winter Cole pears placed in cold storage on 21st March (two days after picking) were lined with waxed paper, while the individual fruits were wrapped in 'copperized' paper, the remainder being left unlined, only 7 per cent. wilt (mostly slight) developed in the former lot, compared with 49 per cent. (23 per cent. severe) in the latter.

WELLMAN (R. H.) & MCCALLAN (S. E. A.). **An analysis of factors causing variation in spore germination tests of fungicides. IV. Time and temperature.**—*Contr. Boyce Thompson Inst.*, xii, 6, pp. 431–449, 12 graphs, 1942.

In a further contribution to this series [*R.A.M.*, xx, p. 543] toxicity curves were established for copper sulphate, zinc chloride, 'Standard Laboratory Bordeaux', red cuprous oxide, and two synthetic organic chemicals on *Sclerotinia fructicola*, *Alternaria solani*, *Glomerella cingulata*, and *Macrosporium* [*Stemphylium*] *sarciniforme* at temperatures of 10°, 15°, 21°, 27°, and 35° C. [ibid., xxi, p. 422]. The counts were made after varying periods from the moment when the spores were first brought into contact with the chemicals, referred to throughout the paper as 'elapsed time'.

It was found that spores of different species did not start germinating at the same time or germinate at the same rate. A linear relation, within limits of experimental error, between reciprocals of elapsed time and germination expressed in 'probits' [ibid., xxii, p. 34] is shown for the spores of all the four species of fungi germinating in water at all the temperatures used. Temperature had a marked effect on the rate of germination of spores of all four species in water, particularly after short periods of elapsed time; all fungi reached 98 per cent. germination or more by 50 hours at all temperatures, except *Sclerotinia fructicola* and *G. cingulata* at 35° where the germination was about 90 per cent. The optimum temperature for germination was between 27° and 35° for *A. solani*, between 21° and 27° for *S. fructicola* and *Stemphylium sarciniforme*, and near 27° for *G. cingulata*. No significant difference in precision was evident between counts made after 6, 12, 24, 48, or 96 hours.

A linear relation between reciprocals of elapsed time and germination expressed in probits was shown to exist when spores are germinated in a given concentration of a chemical, provided the concentration permits germination. The effect of elapsed time in fungistatic tests was found to be the reverse of the usual action of time in toxicity tests at a given concentration. In fungistatic tests the inhibition of germination diminishes as time goes on since the spores continue to germinate and thus give indication of viability. A linear relation is demonstrated for LD50 values by plotting the logarithm of concentration against the reciprocal of elapsed time. This curve is said to be important in the estimation of the potency of a fungistatic agent, since compounds are rated differently at various times on the same fungus, and also because fungi may differ in their relative susceptibility to a single compound, depending on the elapsed time. Slopes of the dosage-response curves [ibid., xxii, p. 72] did not differ significantly for the various elapsed times, provided an appropriate correction was made for control germination.

The effect of temperature was determined by calculating LD50 values of the chemical after 20 hours or more of elapsed time, when the chemical effect had approached an equilibrium with respect to time. No significant difference in LD50 values could be demonstrated at 15°, 21°, or 27°, but there was a temperature effect at 10° and 35°. Compounds were not rated in the same order at 10° and 35°, but in general it took less chemical to give an LD50 value at these extreme temperatures; it took proportionally more chemical to give an LD50 value on *A. solani* at the higher temperatures and on *Sclerotinia fructicola* at the lower temperatures. It is concluded that in spore germination tests, where counts are made after 20 hours or more of elapsed time, temperature need be controlled only within approximately 5° above or below the optimum for spore germination. Generally speaking, time of counting and extreme temperatures are considered to be as important sources of variation in fungistatic tests as is the difference in susceptibility of fungi.

McCallan (S. E. A.) & Wellman (R. H.). **Fungicidal versus fungistatic.**—*Contr. Boyce Thompson Inst.*, xii, 6, pp. 451–463, 4 graphs, 1942.

The fungicidal and fungistatic properties (defined as the ability to kill and inhibit fungi, respectively) of 15 water-soluble chemical compounds were tested on spores of *Sclerotinia fructicola*, *Alternaria solani* [see preceding abstract], *Penicillium expansum*, and *Rhizopus nigricans*. For the fungistatic tests the slide-moist chamber method was employed, ensuring a prolonged contact of spores with the chemicals; in the fungicidal tests the spores were suspended in the chemical solutions for 2·5 to 2,560 minutes, centrifuged, decanted, and washed to remove the chemical, and then allowed to germinate on slides in moist chambers. As, theoretically, the fungicidal activity of a compound cannot exceed its fungistatic activity, the compounds tested could be placed, in respect to all four fungi, in three groups, viz., A, both activities high: this group included silver nitrate, mercuric chloride, sodium hypochlorite, iodine, copper sulphate (except *P. expansum*), crystal violet (except *R. nigricans*), and malachite green (except *P. expansum* and *R. nigricans*); B, both activities low: formaldehyde, acetic acid, phenol, and berberin sulphate; and C, fungistatic activity high and fungicidal activity low: potassium dichromate, uranyl acetate, sodium arsenate, 8-hydroxyquinoline sulphate, copper sulphate (*P. expansum* only), crystal violet (*R. nigricans* only), and malachite green (*P. expansum* and *R. nigricans* only). In a few instances, especially copper sulphate on *S. fructicola*, the addition of a small quantity of ultrafiltered orange juice markedly lowered the fungicidal action. The fungicidal dosage-response curve gave straight lines when plotted on logarithm-probability paper. In many cases, particularly copper sulphate, potassium dichromate, uranyl acetate, sodium arsenate, malachite green, berberin sulphate, and 8-hydroxyquinoline sulphate, the fungicidal curves were decidedly flatter than the corresponding fungistatic ones. Limited data indicated that the fungicidal time-response curves give straight lines when plotted on logarithm-probability paper.

Wilson (J. D.) & Irons (F.). **Specifications of some of the ingredients commonly used in fungicidal dust mixtures.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxvii, 214, pp. 26–41, 4 figs., 1 diag., 1942.

Most dusting equipment works best with applications of 20 to 40 lb. per acre and dilutions with a filter are required to provide an amount of active agent per acre within this range. In order to prepare mixtures it is necessary to know (*a*) the weight-volume relationship and (*b*) the flowing qualities of the different ingredients. A tabulated account is given of the standardized methods of procedure adopted at the Ohio Agricultural Experiment Station to determine the weight (*a*) per cu. ft. and (*b*) per cu. in., particle size, rate of flow, and hydrogen-ion concentration of various fixed coppers and the diluents or carriers and adhesives used as ingredients of these fungicidal dusts [*R.A.M.*, xxi, p. 32]. The weight per cu. ft. was determined by means of a cu. ft.

measure filled in a standard manner, and the weight per cu. in. with a Scott volumeter. The weights per cu. ft. of the diluent materials ranged from 9 lb. for celite to 67 lb. for 325-mesh whiting, with an average of 30 to 45 lb., the corresponding values per cu. in. being from 1·32 to 12·12 (4 to 7) gm., respectively. The weights of the fixed coppers ranged from 26 lb. per cu. ft. for COC-S to 96 lb. per cu. ft. for cuprocide, and from 4·41 to 17·45 gm. per cu. in., respectively. The size of the average particle, measured by means of a filar micrometer attachment on a microscope, varied between about 2 μ in 325-mesh bentonite to nearly 30 μ for many of the talcs, gypsum, and similar substances. Most of the particles were of the granular type, and thus passed more easily through the 44 μ openings between the wires of a 325-mesh screen than would fibrous or flaky materials. The rate of flow of the different samples through Peerless (hand) and Messinger (power) dusters varied considerably with their weight-volume ratios, particle size and shape, friction coefficients, &c., those composed of fibrous particles generally being the slowest and those of coarser texture the most rapid in movement. Most of the preparations were moderately alkaline (P_H8 to 9·3), hydrated lime being extremely so (12·25); pyrax and ABB talc, Cherokee and Perry clays, wheat and soya flours, and phosphate rock showed varying degrees of acidity.

Nielsen (L. W.) & Williamson (C. E.). **The composition and field performance of some silver sprays.**—*Phytopathology*, xxxii, 11, pp. 1027–1030, 1942.

At Cornell University, Ithaca, New York, the writers conducted experiments from 1938 to 1940 to determine the efficacy of three silver sprays in comparison with Bordeaux mixture for the control of potato and celery late blights (*Phytophthora infestans* and *Septoria apii*, respectively), and tulip fire (*Botrytis tulipae*). The composition of the silver sprays was as follows: (1) silver nitrate and sodium lauryl sulphate (as 'dreft') at concentrations of 0·299 to 1·195 and 6·3 to 7·5 gm. per gal., respectively; (2) silver nitrate-ferrous sulphate-hydrated lime (0·598, 0·98, and 0·59 gm. per gal., respectively); and (3) silver nitrate-manganous sulphate-lime (0·598, 0·77, and 0·59 gm. per gal.). There was no significant difference between the silver sprays and Bordeaux mixture (4–4–50) as regards the control of celery late blight, while the former were less effective than the latter (5–2·5–50) in the elimination of *P. infestans*. However, both the silver-lauryl sulphate and the silver-manganous sulphate mixtures combated tulip fire as efficiently as Bordeaux (1·5–4·5–50) in one season's trials. The fact that none of the silver sprays left any objectionable deposit on the treated foliage suggests their potential value as fungicides for certain copper-sensitive plants.

Martin (H.), Wain (R. L.), & Wilkinson (E. H.). **Studies upon the copper fungicides. V. A critical examination of the fungicidal value of copper compounds.**—*Ann. appl. Biol.*, xxix, 4, pp. 412–438, 2 graphs, 1942.

The germination of fungal spores (mainly of *Macrosporium* [*Stemphylium*] *sarciniforme*, but in some trials also of *Venturia inaequalis* and *V. pirina*) exposed to known concentrations of different copper compounds was examined at the Long Ashton Research Station [*R.A.M.*, xvii, p. 260] by either placing the spore suspensions on the deposits obtained by drying sprayed cellulose slides or by mixing them with solutions of the copper compounds on unsprayed slides.

Linear relationships were obtained between the logarithm of the copper concentration and 'probit' [ibid., xxii, p. 145] germination. Since the results in most trials fell on a single line, it was possible to define fungicidal value by two statistics: (*a*) the slope of the line or the regression coefficient, and (*b*) the position of the line or the median lethal dose, the former affording a measure of the inherent toxicity of the fungicide which is largely independent of the particle size of the material, and the latter a measure of the availability of the compound determined by physical factors such as particle size. Sometimes the probit germination points fell on lines of different slope; this happened when (*a*) germination at the lowest concentrations was less or (*b*) greater

than would be expected if the probit germination-dosage curve were a single line, or when (*c*) germination at the highest concentrations was less than would be expected for a single line.

On the assumption that case (*a*) may be explained by the necessity to reach a critical concentration before the mortality-dosage curve becomes normally distributed, and cases (*b*) and (*c*) by the presence, in the spore droplet, of two toxicants of dissimilar action, the results obtained are taken to indicate that a wide group of copper compounds, including cupric chloride, dinitrocresylate, phosphate, sulphanilate, sulphate and sulphide, cuprous oxide (yellow), and Bordeaux and Burgundy mixtures, possess a common regression coefficient attributable to the cupric ion; that basic derivatives such as the basic sulphate, chloride, carbonate, and fluoride yield regression coefficients smaller than that of cupric ion in the approximate ratio 1 : 1 : 2 : 2 (?) : 4; and that derivatives in which co-ordination with the formation of complex ions can occur may exhibit more than one regression coefficient, a trend which can be correlated with the stability of the complex ion. This last conclusion is illustrated by the fact that among the salts of dibasic carboxylic acids, the oxalate usually, and the malonate sometimes, showed regression coefficients lower than that of the cupric ion, whereas the succinate in all tests yielded the same regression coefficient as the cupric ion; of the amino-acid salts, the glycinate frequently yielded the cupric ion slope, the alaninate rarely, the valinate less rarely, and the leucinate yielded only a regression coefficient, which is general among complex amino-cupric derivatives, such as tyrosinate, phenylalaninate, cystinate, aspartate, and glutamate. The copper salts of the hydroxy-acids, lactic, malic, tartaric, and mucic acids, generally yielded regression coefficients of the same order as copper sulphate, but results with cupric malate, sodium and cupric cuprimalates indicated a component of steeper slope. Copper co-ordinated to ethylenediamine gave a lower regression coefficient than that of the cupric ion, the dinitrocresylate being so little toxic that its regression coefficient could not be established. The copper derivative of ethylenediamino-*bis*-acetylacetone exhibited the same regression coefficient as that of the cupric ion, while cupric sebacate, phthalate, and, in one test, the hippurate, yielded steeper lines than that due to the cupric ion, indicating the high inherent toxicity which can be associated with the undissociated molecule. In addition to ethylenediaminocupric dinitrocresylate, the basic arsenate, cupric ferrocyanide, quinaldinate, the copper salt of salicylaldoxime, cuprous iodide, and thiocyanate may be classified as non-fungicidal to the spores tested, this being associated with the high degree of stability and insolubility of these compounds.

On the basis of these results the following hypotheses are proposed concerning the mode of toxic action: (*a*) in the case of Bordeaux and Burgundy mixtures and most relatively insoluble derivatives yielding the regression coefficient of the cupric ion, it is solution by the spore exudate by complex ion formation yielding cupric and complex ions of which the cuprimalate is that of most direct toxicity; (*b*) in the case of soluble derivatives readily yielding cupric ions, it is interaction with spore exudate, fungicidal action operating as in (*a*); (*c*) in the case of yellow cuprous oxide, it is decomposition by which half the copper reaches the spore by the cupric ion route; (*d*) in the case of red cuprous oxide, cupric oxide, basic copper compounds, and the complex amino-acid derivatives fungicidal action seems to follow a more complicated series of reactions the nature of which is as yet unknown; and (*e*) in the case of sebacate and phthalate the undissociated molecule may be directly fungicidal, an action independent of cupric ion formation.

Hoffman (C.), Schweitzer (T. R.), & Dalby (G.). **The fungistatic properties of pyridine carboxylic and aminobenzoic acids, a resonance effect.**—*J. Amer. pharm. Ass.*, xxxi, 4, pp. 97–99, 1 graph, 1942.

In further studies at the Ward Baking Company, New York, on the toxicity of benzoic acid and related compounds to a number of common food spoilage moulds,

including *Aspergillus niger*, *A. glaucus*, *Rhizopus nigricans*, and *Penicillium frequentans* [*R.A.M.*, xix, p. 667] on nutrient agar containing 1 per cent. sucrose at 37·5° C., the ortho-pyridin carboxylic (picolinic) acid showed fungistatic properties, which did not, however, equal those of benzoic acid [cf. ibid., xxi, p. 334]. The ortho-aminobenzoic (anthranilic) acid is slightly less potent than benzoic, while the meta-aminobenzoic acid is a very weak inhibitor of mould growth and nicotinic and isonicotinic acids are without effect. The molar concentrations of benzoic acid necessary for the inhibition of fungal development at P_H2, 5, and 6 were found to be 0·0016, 0·0074, and 0·0532, respectively. The bearing of these data on the relationship between fungistatic capacity and molecular structure in the benzene ring nucleus is briefly discussed.

POLUNIN (N.). **High-concentration hydrogen cyanide fumigation of fungi and bacteria.** —*Nature, Lond.*, cl, 3815, p. 682, 1942.

When two rooms of the Druce Herbarium at Oxford were fumigated for 50 hours with gaseous hydrogen cyanide in a concentration of over 30 mg. per l. (about 2·6 per cent. 'by vol.'), growth was arrested in exposed Petri dish cultures of *Penicillium frequentans*, *Aspergillus* sp., or [unidentified] fungi and bacteria obtained by exposing for 10 minutes agar plates in the same rooms before fumigation; and no growth occurred on sterile exposed plates for ten days, after which time slight growth developed on some of them. It is concluded that the colonies were killed by the fumigant and malt agar plates rendered temporarily or permanently inhibitant to the growth of organisms present in the air of the rooms, though it was not determined whether the colonies were killed by gaseous hydrogen cyanide or by that adsorbed by the agar gel. It is suggested that the possibility of useful application of fumigation for the sterilization of rooms soused by rain or firemen's hoses (e.g., bombed museums, damaged stores) being not inconsiderable, the relative merits of other fumigants, in particular formaldehyde, should be investigated without delay.

PADWICK (G. W.). **Recent advances in control of fungous diseases of plants.**—*Indian Fmg*, iii, 9, pp. 479–481, 1942.

The writer discusses and illustrates by means of concrete examples some recent advances in the control of plant pathogens. The problem may be approached along various lines, including plant sanitation, comprising all measures for the removal and destruction of infected material; the adjustment of the physical and nutrient conditions of the soil in such a way as to promote the well-being of the crop and arrest the development of the fungus; the breeding of resistant varieties (one of the most popular fields of endeavour of phytopathologists in India, where selection for resistance to a number of important diseases is in progress); and spraying or dusting with an approved fungicide.

STUART (L. S.) & HARRIS (T. H.). **Bactericidal and fungicidal properties of a crystalline protein isolated from unbleached Wheat flour.**—*Cereal Chem.*, xix, 2, pp. 288–300, 1 fig., 1 graph, 1942.

At the Bureau of Agricultural Chemistry and Engineering, United States Department of Agriculture, Washington, D.C., A. K. Balls, W. S. Hale, and T. H. Harris separated from the petroleum ether extract of unbleached wheat flour a crystalline, water-soluble, alcohol-insoluble polypeptide containing about 4·5 per cent. sulphur in the form of cystine and being completely precipitated by 2·5 per cent. trichloracetic acid (*Cereal Chem.*, xix, pp. 279–288, 1 fig., 1942). The experiments herein described and tabulated revealed intensive *in vitro* bactericidal activity of the protein, more especially against Gram-positive organisms: in one trial, destruction of the cells of *Staphylococcus aureus* occurred in dilutions as low as 0·005 mg. per ml. The protein likewise exhibited marked fungicidal activity towards the true yeasts, *Saccharomyces cerevisiae*, *Debaryomyces nadiformis* (*Torula histolytica*), and *Endomycopsis*

albicans, the cells of which were also killed at dilutions of 0·005 mg. per ml. and upwards. These results suggest the possible utilization of the protein as a fermentation regulator on the one hand, and on the other, as a mode of therapy in the case of such maladies as tropical sprue and blastomycosis. The mycelial fungi, represented by *Aspergillus niger* and *Rhizopus nigricans*, responded negatively to contact with the protein.

FRIES (N.). **Über das Wuchsstoffbedürfnis einiger Ophiostoma-Arten.** [On the growth substance requirement of some *Ophiostoma* species.]—*Svensk bot. Tidskr.*, xxxvi, 4, pp. 451–466, 1 graph, 1942.

Three species of *Ophiostoma*, viz. *O.* [or *Ceratostomella*] *ulmi* from elm (a Dutch isolation,) *O. coeruleum* [or *C. coerulea*], and *O.* [or *C.*] *stenoceras*, the two latter from ground wood pulp in Sweden [*R.A.M.*, xiv, p. 274], made only rudimentary growth on a synthetic aqueous medium containing glucose, ammonium chloride or tartrate, and inorganic salts, the assimilation of which was facilitated, however, by an admixture of minute quantities of malt or yeast extract. Attempts to replace these extracts by chemical substances gave the following results. The addition of adermin (vitamin B_6) to the substratum at the rate 1 mγ per 25 c.c. induced luxuriant mycelial growth in cultures of *C. ulmi*, while the other two species responded similarly to aneurin or pyrimidin, the effect of which was further strengthened by biotin and, in the case of *O. coeruleum*, by adermin.

CLAYTON (E. E.). **The germination of fungous spores in relation to controlled humidity.** —*Phytopathology*, xxxii, 11, pp. 921–943, 2 figs., 6 graphs, 1942.

The method adopted by the author for the accurate regulation of high relative humidities for spore germination tests [cf. *R.A.M.*, xvii, p. 56 *et passim*] involved the use of clean, dry carriers (surfaces of glass, paraffin, quartz, or leaves), over which the spores were discharged naturally or dusted with a camel-hair brush. The carriers were then suspended in sealed glass chambers (1-qt. fruit jars with glass lids and rubber gaskets) over sucrose or saturated salt solutions or re-distilled water to secure the desired relative humidities, which were computed theoretically, the chambers being placed in a wire container and completely submerged in a water bath with a temperature thermostatically maintained at 20·0±0·02° C. Mechanical rocking of the container obviated stratification of the atmospheres or the solutions within the chambers. Only to a limited extent at a relative humidity of 100 per cent. was condensation visible on the spore-carriers.

The conidia of *Sclerotinia fructicola* germinated well in re-distilled water, but not over a period of 72 hours on glass, paraffin, or quartz at relative humidities of or below 100 per cent.

The germination of ascospores and conidia of *Venturia inaequalis* from apple leaves on dry glass at a relative humidity of 99 to 100 per cent. was demonstrated for the first time, the mean germination percentages of the ascospores after 24 hours at 100, 99·6, and 99 being 85±4, 28·2±5·4, and 0 to 23, respectively; the corresponding figures for wet and dry conidia at the same relative humidities were 74, 67, and 9, and 79, 52, and 14, respectively.

The mean percentage germination of uredospores of *Puccinia coronata*, *P. graminis tritici* (race 56), and *P. g. avenae* (race 2) was high in water (89, 97, and 99, respectively), but fell progressively at a relative humidity of 100 and 99 per cent. and was practically nil at 98.

It was shown for the first time that chlamydospores of *Ustilago hordei* and *U. nuda* on dry glass or paraffin were capable of germination at relative humidities of 95 to 100 per cent. but not at or below 93. Long basidial hyphae (67 μ after 48 hours) were produced at 100 to 95 per cent. relative humidity, whereas the basidia of spores germinating on water gave rise to sporidia.

Conidia of *Erysiphe polygoni* from red clover, cabbage, and evening primrose (*Oenothera biennis*) on dry glass germinated at relative humidities from 0 to 100 per cent.; at the lower ranges, however, the germ-tubes were very short and survived only for brief periods [ibid., xvi, p. 104].

Cook (H. T.) & Houghland (G. V. C.). **The severity of Potato scab in relation to the use of neutralized and one-third neutralized fertilizers.**—*Amer. Potato J.*, xix, 10, pp. 201–208, 1 graph, 1942.

Further experimental data are presented in support of the conclusion already reached that the occurrence and severity of potato scab [*Actinomyces scabies*] are influenced by the type of fertilizer only in so far as the latter affects the soil reaction [*R.A.M.*, xviii, p. 475]. In the present series of tests at the Virginia Truck Experiment Station, bringing the total period of the observations under review to seven years, the use of a neutralized kieserite or dolomitic limestone fertilizer resulted in a less acid reaction (P_H 5·2 to 6) and consequently more scab (35·33 per cent.) than a one-third neutralized (P_H 4·7 to 5·1 and 13·34 per cent., respectively).

Wakely (C. T. N.) & Mellor (H. C.). **Seed Potato disinfection by conveyor belt dipper.**—*Nature, Lond.*, cl, 3817, p. 769, 1942.

To facilitate the disinfection of large quantities of seed potatoes [against common scab (*Actinomyces scabies*), surface-borne *Phytophthora infestans*, and storage rots], a plant utilizing the conveyor belt principle has been devised. A dipping tank holding approximately 600 gals. fluid is provided with a conveyor belt operating below the surface of the solution. The plant can be worked in conjunction with the usual type of grader, the potatoes being delivered from the picking belt of the grader down a wooden chute into the solution, where they travel horizontally for one minute, after which they pass up out of the tank at an angle of 30°. The elevator delivers them into boxes which are immediately removed to the open field and stacked up for drying, which takes only a few minutes. During the present lifting season, over 1,000 tons seed potatoes were treated by two of the plants, a well-known organo-mercury potato disinfectant being used.

Cadman (C. H.). **Autotetraploid inheritance in the Potato : some new evidence.**—*J. Genet.*, xliv, 1, pp. 33–52, 1 pl., 1 diag., 1942.

The present study furnishes data in support of the contention that the cultivated potato, with $2n = 48$ chromosomes, regarded by many geneticists as a functional diploid, is in fact an autotetraploid. The experiments are based on the observation that individual potato varieties react to graft inoculation with potato viruses X, A, B, and C by either developing lethal top necrosis or only leaf mosaic of varying degree of intensity. Consequently the presence of top necrosis and its absence are treated as a pair of clear-cut alternative characters. As the potato varieties were found to react essentially similarly to each of the four viruses, reactions to virus X were singled out for detailed consideration. The necrotic reaction to virus X was found to be associated with the dominant allele of a gene designated **nx.** The segregation of this gene in crosses between commercial potato varieties proved to be tetrasomic. Most necrotic-reacting varieties were found to be simplex for the dominant allele; so far only one duplex type was found. The two phases of dominance were indistinguishable phenotypically. It is concluded from these data and from the results of recent genetical work that autotetraploidy offers a sound hypothesis for further investigation.

These conclusions have the following practical significance. It was observed that plants reacting by lethal necrosis to graft infection with virus X in the laboratory were virtually immune from this virus under field conditions. It is suggested that

there should be no difficulty in synthesizing breeding stocks quadruplex for the **Nx** allele and thus producing economically useful varieties field immune from virus X.

Sethi (D. R.). **Cold storage of seed Potatoes.**—*Indian Fmg*, iii, 9, pp. 471–473, 1942.

Losses among stored seed potatoes in the Indian plains due to insect pests and fungal diseases may be very substantial, ranging from 25 to 60 per cent. Directions are given for the complete control of these forms of damage by cold storage at a temperature of 36° F. and a humidity of 75 to 85 per cent. Attention is drawn to certain precautions in the design and construction of the cold store, the method of loading, and the maintenance of proper conditions during the storage period. The potatoes should be left for at least 12 hours in a pre-cooling chamber at 60° to 70° and removed to the chambers for 24 to 72 hours after storage. Potatoes for table use require an entirely different set of conditions for their preservation.

Ruschmann (G.) & Pozdena (L.). **Beziehungen zwischen physikalischer und biologischer Bodenerkrankung.** [Relations between physical and biological soil sickness.]—*Zbl. Bakt.*, Abt. 2, cv, 12–13, pp. 213–233, 4 diags., 1 graph, 1942.

A comprehensive, tabulated account is given of the writers' comparative analyses of the physical, chemical, and biological properties of two genetically and morphologically contrasting soil profiles in the vicinity of Landsberg-an-der-Warthe, one situated in the marshes bordering the river and the other (heavy podsol) in a forest on the diluvial plain. The physical and chemical anomalies of both soils were clearly reflected in their biological relationships, as expressed in the extent and composition of their microflora [*R.A.M.*, xxi, p. 502]. In the former, notwithstanding its exceptionally favourable humus content, the total micropopulation was only moderately high, presumably on account of insufficient physiological humidity and an unbalanced distribution of water and air, the adverse effects of which were particularly noticeable in the case of the moulds: at a depth of 0 to 14 cm. (P_H 4·7) the numbers of bacterial spores, Actinomycetes, and moulds per gm. oven dry soil were 1,100,000, 3,400,000, and 39,000, respectively, the corresponding figures at 52 to 75 cm. (P_H 5·6) being 15,600, 14,000, and 1,100, respectively. On the other hand, in the very acid upper layers of the forest podsol, moulds predominated over both the other groups, the numbers of bacterial spores, Actinomycetes, and moulds at a depth of 0 to 8 cm. (P_H 3·3), for instance, being 85,000, 100,000, and 106,000, respectively, whereas in the deeper strata the approach of the hydrogen-ion concentration to neutrality promoted a relatively increased activity on the part of the bacteria and Actinomycetes, the numbers of which at 110 to 150 cm. (P_H 4·8) were 16,000 and over 1,000, respectively, compared with 800 for the moulds. The total micro-populations of the marsh and its profiles (per gm. soil) at 0 to 14 and 52 to 75 cm. were 10,039,000 and 156,000, respectively, the corresponding figures for the forest at 0 to 8 and 110 to 150 cm. being 726,000 and 49,000, respectively, from which the weakness of microbial activity in the latter, attributable in the first place to its advanced podsolization and consequent low P_H values, is apparent.

Evans (H.). **New light on red rot disease of Sugar Cane.**—*Rep. Mauritius Sug. Cane Res. Sta.*, xii, pp. 25–26, 1941. [Abs. in *Sugar*, xxxviii, 1, pp. 43–44, 1943.]

Physiological investigations, as yet incomplete, of the basis of resistance to red rot (*Colletotrichum falcatum*) in sugar-cane indicate that the reaction of the host to the pathogen is associated with the amount in the former of an amino-phenol of the tyrosin type. It appears that varieties of an extreme degree of resistance or susceptibility to the disease may be immediately recognized by determinations of this chemical substance, whereas in those of intermediate reaction the rôle of the borer [*Proceras sacchariphagus*], which is in turn dependent on the lignin content of the rind, must also be taken into consideration.

Agriculture and animal industry in India, 1938–39.—422 pp., 9 pl. (1 col.), 1 map, Delhi, Imperial Council of Agricultural Research, 1941.

Most of the information regarding plant disease investigations (pp. 143–151) in this review has been noticed from other sources [cf. *R.A.M.*, xix, pp. 258, 583, *et passim*], but the following may be mentioned. Under the Imperial Council of Agricultural Research scheme of investigations into sugar-cane diseases 41 varieties were tested for resistance to red rot (*Colletotrichum falcatum*) and wilt (*Cephalosporium sacchari*). The varieties most susceptible to the former were Co. 362, 531, 526, 223, 417, 419, 421, Co. K. 10, Co. K. 22, and Dehra Dun Ponda [cf. ibid., xxi, p. 347], and to the latter Co. 421, 441, 419, 413, 331, 360, and 528. In Madras, 11 varieties were tested for red-rot resistance, and all except Co. 281 were found to be highly susceptible. Tests of the rate of spread of *C. falcatum* from infected setts to new shoots showed that in the Vellai variety the rate of spread from sett to shoot was very rapid, whereas in P.O.J. 213 no spread had occurred after 3½ months. This result is of interest in view of the fact that P.O.J. 213 almost went out of cultivation in America as a result of the red-rot epidemic of 1930. The strain occurring in Madras is a dark one, and this, presumably, was the strain used in the experiments. The American epidemic was caused by a light strain, which may account for the behaviour of P.O.J. 213.

Wehmeyer (L. E.). **Contributions to a study of the fungous flora of Nova Scotia. VI. Pyrenomycetes.**—*Canad. J. Res.*, Sect. C, xx, 12, pp. 572–594, 18 figs., 1942.

In this contribution [*R.A.M.*, xx, p. 135] the author gives an annotated list of 170 species, including seven new to science, and two varieties of fungi belonging to 70 genera of Pyrenomycetes collected in Nova Scotia.

Seaver (F. J.). **The mycoflora of Bermuda.**—*Science*, N.S., xcvi, 2499, pp. 462–463, 1942.

In the course of this account of his mycological explorations of Bermuda, which were inaugurated (in the company of N. L. Britton) over 30 years ago, the writer briefly describes a few of the more interesting species of fungi collected, in some cases in collaboration with H. H. Whetzel or J. M. Waterston [*R.A.M.*, xxii, p. 113], with special reference to the connexions between the Islands and the continents of Europe and North America in respect of the geographical distribution of these organisms.

Hesler (L. R.). **Notes on Southern Appalachian fungi, IV.**—*J. Tenn. Acad. Sci.*, xvii, 3, pp. 242–249, 4 figs., 1942.

This is a continuation of the author's critically annotated list of rare or otherwise interesting fungi recently collected in eastern Tennessee and western North Carolina [cf. *R.A.M.*, xx, p. 323].

Henry (L. K.). **A review of the pileate Polypores of western Pennsylvania.**—*Ann. Carneg. Mus.*, xxviii, 13, pp. 221–272, 4 pl., 1941.

This is an annotated list of 96 Polyporaceae collected in western Pennsylvania, of which 28 are rare in the area under observation and two recorded for the first time in the State.

Lindquist (J. C.). **Micromicetos nuevos para la flora argentina.** [New micromycetes for the Argentine flora.]—*Darwiniana, B. Aires*, v, pp. 241–247, 1941.

The present contribution to the available information on the mycoflora of the Argentine forms a continuation of Parodi and Hauman's list of fungal parasites of cultivated plants (*Rev. Fac. Agron., B. Aires*, iii, pp. 227–274, 1921), and comprises technical diagnoses of, and critical notes on, 21 fungi, including *Pseudoplea briosiana* [*P. trifolii*] (syn. *Pleosphaerulina briosiana*) on lucerne, *Ascochyta atropae* on *Atropa belladonna*, *A. bohemica* on *Campanula media*, *A. cannae* on *Canna indica*, *A. gossypii*

on cotton, *A. lathyri* on sweet pea, *Septoria digitalis* on *Digitalis purpurea*, *S. gladioli* on gladiolus, *S. henriquesii* f. *santonensis* on *Matthiola incana*, *S. macrospora* on *Chrysanthemum leucanthemum*, *S. rosae* on rose, *Colletotrichum violae-tricoloris* on sweet violet, *Cercospora apii* var. *carotae* on carrot, and *C. resedae* on *Reseda odorata*.

Milthorpe (F. L.). **Studies on Corticium rolfsii (Sacc.) Curzi (Sclerotium rolfsii Sacc.). I. Cultural characters and perfect stage. II. Mechanism of parasitism.**—*Proc. Linn. Soc. N.S.W.*, lxvi, 1–2, pp. 65–75, 1 pl., 7 figs., 1941.

Studies on eight isolates of *Corticium rolfsii* [*R.A.M.*, xi, p. 748; xxi, p. 130], the agent of severe damage to a number of crops in New South Wales, are fully described and tabulated.

The abundance and type of vegetative growth were found to be largely determined by the nature of the medium and the temperature at which the cultures were maintained, the same factors likewise influencing the quantity and size of the sclerotia, but not their shape or colour. Thus, on carrot agar, growth is white, dense, and feathery, on potato dextrose agar the mycelium is more luxuriant than on onion or onion-proteose-peptone agars, peptone dextrose broth gives rise to a very feathery, thick, densely flocculent, and rapidly spreading mycelium, in contrast to the sparse development on pectin broth. Sclerotial production was more profuse on carrot and potato dextrose than on the onion agars. Two of the isolates produced large, somewhat irregular, and relatively few sclerotia, while in the others these organs were small, globose, uniform, and numerous.

Growth on potato dextrose agar (the medium used for the temperature studies) proceeded very slowly at 15° C., increased rapidly with a rise to 25°, and reached an optimum at 30°, above which there was a speedy decrease to a minimum at 37°. Sclerotial production reached a maximum at 25° to 30°, falling off at 37° and 20°, especially at the lower temperature.

Three of the isolates formed fructifications on onion-proteose-peptone and potato dextrose agars, the former substratum being preferable for this purpose. This is the first record of the perfect stage of the fungus for Australia. The basidia arising from the dense, white, crustiform hymenia are hyaline, clavate, 2·01 to 5·61 by 1·67 to 3·61 (mean 4·16 by 2·47) μ, and produce at their apices four tapering sterigmata, 1·34 to 2·57 (1·95) μ in length; the hyaline, piriform to globose basidiospores measure 1·64 to 2·51 by 1 to 1·72 (1·94 by 1·37) μ. The slight divergence between the Australian isolates and Curzi's description of *C. rolfsii* are not considered to warrant specific differentiation, though certain affinities with *C. centrifugum* [ibid., xiii, p. 273] in respect of vegetative growth are recognized. Distinct variations in the growth habits of seven monobasidiosporidial cultures were observed, the increase in mean diameter of the colonies, for instance, ranging from 10 to 32 mm. in 24 hours; only three of the cultures produced hymenia, and evidence of heterosexuality could not be demonstrated. It is concluded either that sporulation can only be induced by certain specific conditions, or that the capacity for fructification is readily lost, the former theory being the more plausible.

The mechanism of parasitism by *C. rolfsii* was studied in germinating bean [*Phaseolus vulgaris*] seeds inoculated through the hypocotyls with a mycelial suspension of the pathogen and incubated at 30°. On reaching the cuticle the small mycelial strands form appressoria and penetration hyphae, which enter the epidermal cells, causing plasmolysis and death. Within the invaded tissues, many more large, oval appressoria are formed. The hyphae, coenocytic at first, gradually acquire cell walls. They are usually multinucleate at all stages of invasion, growing parallel to the long axis of the cell, more rarely obliquely, and seldom across. Death of the cytoplasm precedes hyphal invasion to a depth of one layer. When the cells are fully permeated by the hyphae, the nuclei disintegrate and disappear. Dissolution of the middle lamella was apparent at an early stage in the activity of the pathogen, the rapid

maceration of the tissues denoting the presence of a pectilytic enzyme. Investigations on the nature of the toxic principle by the methods of Davison and Willaman [ibid., vii, p. 192] revealed the production of both protopectinase and pectinase, to the activity of which the pathological effects on the plant tissues are attributed.

Salvin (S. B.). **Preliminary report on the intergeneric mating of Thraustotheca clavata and Achyla flagellata.**—*Amer. J. Bot.*, xxix, 8, pp. 674–676, 2 figs., 1942.

After stating that many species of the Saprolegniaceae combine asexual characters of two or more genera of this family, and citing a number of examples, the author expresses the view that the mixed characteristics of these species may indicate primitiveness or may be the result of intergeneric matings. Experiments were therefore conducted to determine whether such matings can be induced between two homothallic species with diclinous antheridia. Fifty-one combinations of species were tried, but only that between *Thraustotheca clavata* and *Achyla flagellata* resulted in interspecific matings. Under the experimental conditions, as the oogonia of *A. flagellata* developed beside the hyphae of *T. clavata*, antheridia of the latter were formed and became attracted to the adjacent oogonia. The antheridia later became attached, formed fertilization tubes, and appeared to induce fertilization, oospores being observed soon after.

These results are the first to indicate that sexual fusion may take place between the homothallic thalli not only of two separate species, but also of two separate genera. Until, however, the oospores are germinated, and the characteristics of the resulting generations have been studied, the work does not conclusively prove that sexual or nuclear fusion took place between the two species.

It is concluded that considerable significance attaches to these intergeneric matings of two homothallic species. They indicate that sexual fusion in nature may well occur between homothallic species of the same or different genera of the Saprolegniales. A further inference is that species with intermediate asexual characters may have originated from interspecific hybridization, while the sudden appearance of an atypical method of asexual reproduction in a given species may be similarly explained. There is also an indication that the modern concept of a genus in the Saprolegniaceae may be inadequate, since it fails to consider the possible mingling of characters that may result from intergeneric matings.

Brodie (H. J.). **Protoplasmic continuity in the powdery mildew Erysiphe graminis DC.**—*Canad. J. Res.*, Sect. C, xx, 12, pp. 595–601, 1 pl., 1 fig., 1942.

The study of living mycelial and conidial cells of the barley powdery mildew, *Erysiphe graminis*, at the University of Manitoba, Canada, with the help of a slight modification of Wahrlich's staining technique [*R.A.M.*, xii, p. 776], revealed that the protoplasm is continuous from cell to cell, the delicate strand of cytoplasm, 1 to 1·5 μ wide, passing through minute central pores in the transverse septa. These findings were recorded by means of photomicrographs and drawings. The author failed to detect streaming of cytoplasm by direct observation, this being possibly due to the slow rate of flow or to the difficulty of examining the mycelium without disturbing it.

Bedford (C. L.). **A taxonomic study of the genus Hansenula.**—*Mycologia*, xxxix, 6, pp. 628–649, 1942.

Of the 100 cultures of yeasts obtained from various sources in the United States, Europe, Asia, and South Africa as species of *Hansenula*, 79 were left by the author in this genus, while six were placed in *Pichia*, eight in *Candida*, two each in *Torulopsis* and *Zygohansenula*, and one in *Brettanomyces*.

Roelofsen (P. A.). **Recent research at the Deli Tobacco Experiment Station, Medan, Sumatra.**—*Emp. J. exp. Agric.*, xi, 41, pp. 15–22, 1943.

An account is given of some of the recent activities of the agricultural, botanical,

entomological, and agrochemical departments of the Deli Tobacco Experiment Station, Medan, Sumatra, reference to the phytopathological aspects of which has already been made from time to time in this *Review*.

Smith (T. E.). **Investigations of control measures for Granville wilt of Tobacco.**—Abs. in *J. Elisha Mitchell sci. Soc.*, lviii, 2, p. 133, 1942.

Experiments have been in progress in North Carolina since 1935 to develop more effective measures for the control of Granville wilt (*Bacterium solanacearum*) of tobacco [*R.A.M.*, xvii, p. 787]. A considerable reduction in the incidence of the disease was effected by triennial rotations with maize, soy-beans, or red top grass [*Agrostis palustris*], but the complete elimination of the pathogen by this means appears unlikely. Soil treatment with chloropicrin is efficacious but too expensive for large-scale use. Promising results were given by a combination of a maize rotation with the application to the soil of urea (uramon) at the rate of 1,000 lb. per acre. A high degree of genetic resistance to the wilt was found in a collection of tobacco from Colombia, and progress has been made by hybridization and selection towards the development of resistant varieties of flue-cured tobacco.

Lóos (C. A.). **Some virus diseases of Stachytarpheta.**—*Trop. Agric.*, xcviii, 1, pp. 8–12, 2 pl., 1942.

Stachytarpheta jamaicensis, a common weed of the low and mid-country of Ceylon, is subject to three virus diseases, namely, mosaic (yellow blotch), rosette, and yellow veinbanding, of which the two first-named are thought to be new records for the host in question, while the symptoms of the last-named are similar to those already described for *Ageratum conyzoides* [*R.A.M.*, xx, p. 605]. The mosaic and rosette symptoms were transmitted from diseased to healthy plants by grafting. Of no intrinsic importance, *S. jamaicensis* may well assume considerable significance as the host of a virus, probably of the tobacco leaf-curl group.

Cohen (S. S.). **New crystalline forms of Tomato bushy stunt virus.**—*Proc. Soc. exp. Biol., N.Y.*, li, 1, pp. 104–105, 2 figs., 1942.

By the use of the author's new technique (*J. biol. Chem.*, cxliv, 2, pp. 353–362, 1942), employing hydrophilic colloidal materials, such as heparin and starch, new crystalline forms of tomato bushy stunt [*R.A.M.*, xxi, p. 425] and tobacco necrosis (unpublished data of the author and W. M. Stanley) have been obtained. In the case of tomato bushy stunt two previously undescribed crystalline forms of the virus were observed, one consisting of non-birefringent, octahedral prisms, up to 0·2 mm. in length, the ends of which are tapered by joint triangular planes, and the other of rhombohedral, also non-birefringent crystals. The sedimentation constant of the dissolved crystals was that normal for tomato bushy stunt and no significant change in virus activity was apparent from inoculation tests on *Nicotiana glutinosa* and cowpea.

Stanley (W. M.) & Anderson (T. F.). **Electron micrographs of protein molecules.**—*J. biol. Chem.*, cxlvi, 1, pp. 25–30, 2 pl., 1942.

As a preliminary to the examination by the electron microscope [*R.A.M.*, xx, p. 428 *et passim*] of five proteins of varying molecular size, including tomato bushy stunt, a similar study was made of a dilute solution of silver nitrate (supplying the high density essential to satisfactory contrast relations) containing 0·01 mg. ultracentrifugally purified tobacco mosaic virus per c.c. The highly magnified reproduction of an electron micrograph of this preparation shows rods of the virus 150 Å wide and of low contrast scattered over the field, together with numerous small particles, presumably of silver, formed during the preparation and evaporation of the collodion membrane mount.

The 113 particles of a similarly purified and mounted tomato bushy virus prepara-

tion revealed on the micrograph measured on an average 26 mμ in diameter, thereby confirming the results of previous determinations by indirect methods [ibid., xx, p. 38 *et passim*].

Wilson (J. D.) & Moore (W. D.). **Comparison of sprayed Tomato plants grown as seedlings in Georgia and Ohio.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxvii, 214, pp. 17–25, 1942.

This is a tabulated survey of the results of comparative experiments conducted from 1938 to 1940 to determine the effects of Bordeaux mixture and certain fixed copper compounds on various tomato diseases, two lots of plants being used in each year, one raised in Ohio and the other (from the same seed stocks) in Georgia, which supplies more than half the acreage of the canning crop grown in the northern State [*R.A.M.*, xxi, pp. 230, 432]. The Marglobe variety was tested in 1938 and 1940 and Greater Baltimore in 1939. Bordeaux mixture, though very effective against foliar diseases, including early blight (*Alternaria solani*) and leaf spot (*Septoria lycopersici*), caused heavy reductions in yield, so much so, in fact, that the treated plants sometimes produced less than the controls: coposil proved similarly injurious in 1938. In 1939 blossom-end rot was more severe on treated than on untreated plants, a possible indication that fungicidal applications tend to enhance the adverse effects of a deficiency of atmospheric and soil moisture [ibid., xvi, p. 420]. In two trials in which anthracnose fruit rot (*Colletotrichum phomoides*) was troublesome, the treated plots yielded much more heavily than the controls. Bordeaux mixture should not be applied to the southern-grown plants for several days before pulling for shipment to Ohio. The spraying, ten days after arrival in Ohio, of plants inoculated with *A. solani* before dispatch from Georgia arrested the progress of the foliar phase of the disease but did not eliminate the stem cankers.

Cunningham (G. H.). **Disease-free seed for Tomato growers.**—*Orchard. N.Z.*, xiv, 9, pp. 23–24, 1941.

The three major tomato diseases in New Zealand, viz., tobacco mosaic, bacterial canker (*Aplanobacter* [*Corynebacterium*] *michiganense*), and leaf mould (*Cladosporium fulvum*), are stated to be responsible for annual losses totalling upwards of 50 per cent., representing an actual cash loss of some £70,000. With a view to reducing the amount of damage from the last-named, four resistant or immune varieties have been imported from overseas and grown on a large scale under glass in the Owairaka area, namely, Kondine Red, Bay State, Globelle, and Vetomold [*R.A.M.*, xxii, p. 81], of which the last named proved to be the most satisfactory. A survey of its reactions to the physiologic strains of the pathogen present in the Dominions revealed its immunity. It is similar to Kondine Red in appearance and even more prolific. In Bay State the character for resistance is not yet fixed, about 5 per cent. of the plants having contracted leaf mould. Globelle was immune from *C. fulvum*, but yielded poorly and the fruits showed a tendency to crack. Efforts are being made to overcome these defects by means of appropriate crossing. Leaf mould developed early in Kondine Red, but was held in check by spraying with shirlan AG (3 lb. in 100 gals. water).

Haracsi (L.). **A Cseresek veszedelme : a kétalakú tupló (Fomes obliquus (Pers.) Fries).** [The dimorphous (oblique) wood rot (*Fomes obliquus* (Pers.) Fries): an enemy of *Quercus cerris*.]—*Erdész. kisérl.*, xliii, 1–2, pp. 1–31, 10 figs., 1941. [German summary. Abs. in *Biol. Abstr.* xvi, 10, p. 2337, 1942.]

At the Forestry Research Institute, Sopron, Hungary, the writer ascertained that the dark brown knobs on the bark of *Quercus cerris*, birch, and other trees are not sterile or abnormal fruiting bodies of *Fomes nigricans* but the conidial cushions of *F. obliquus* [*Poria obliqua*: *R.A.M.*, xix, p. 56], which produces two forms of sporophores, one tuberous and the other tubular. The (conidio-)chlamydospores of the

knobs are asexual reproductive organs, the sexual phase being represented by the basidiospores arising from the tubular fruiting bodies. Chlamydospores may also be produced by the brown mycelium covering the surface of decayed wood. *P. laevigata*, which occurs on birch, is probably identical with *P. obliqua*. The fungus constitutes a serious menace to *Q. cerris* stands by reason of its wide distribution and intense wood-destroying activity.

Johnson (L. P. V.) & Linton (G. M.). **Experiments on chemical control of damping-off in Pinus resinosa Ait.**—*Canad. J. Res.*, Sect. C, xx, 12, pp. 559–571, 1942.

In greenhouse and nursery experiments conducted from 1939 to 1942 at Ottawa and Orono, Canada, the best control of the damping-off disease of red pine (*Pinus resinosa*) seedlings [*R.A.M.*, xviii, p. 561] resulted from applications to the soil of semesan solution in concentrations of 1 : 100 to 1 : 150 at the time of sowing and at emergence in the greenhouse, or at bi-weekly periods from the time of sowing until four to five weeks after emergence in the nursery. In the greenhouse this treatment was equally or slightly more effective than steam sterilization of the soil. The next best results, particularly in the greenhouse, were obtained with red copper oxide suspension in concentrations of 1 : 250 to 1 : 500 applied to the soil following the same time-table as given above for semesan. Seed treatment with red copper oxide and zinc oxide dusts gave effective control in the greenhouse. Under greenhouse conditions combined seed and soil treatments were no more effective than either of them applied separately, while under certain nursery conditions the combined treatments were significantly less effective. Dusts proved generally greatly superior to liquid materials for seed disinfection, and fungicides as a group more constantly effective than acidifying agents such as sulphuric acid and aluminium sulphate. The fact that acidification gave little or no control in seasons of excessive rainfall or drought is presumed to be related to the reduction of acidity to a non-effective level through removal by percolation in the one case and the action of the slightly alkaline irrigation water in the other. It is assumed that whereas fungicides kill the damping-off organisms, acidification only prevents their development by conditioning an unfavourable environment. Seedlings from two-year-old pine seed of somewhat reduced vitality were found to be far more susceptible to damping-off than those from one-year-old seed. White spruce (*Picea glauca*) used in some of the preliminary tests proved to be much less susceptible to damping-off than red pine, although very similar in response to the various treatments.

Pomerleau (R.). **Études sur la fonte des semis de conifères.** [Studies on the damping-off of conifer seedlings.]—*Rev. trim. canad.*, xxviii, 110, pp. 127–153, 1 fig., 3 graphs, 1942.

Some of the conclusions drawn from the author's intensive six-year studies on damping-off of red pine [*Pinus resinosa*] and white spruce [*Picea glauca*] in Quebec have already been summarized from another source [*R.A.M.*, xxi, p. 508], but the following points may be of interest. Apart from the heavy losses, amounting to nearly 100 per cent., caused by the pathogens (*Pythium de Baryanum*, *Rhizoctonia* [*Corticium*] *solani*, and *Fusarium* spp.) at the warm soil temperatures (of 60° F. and upwards) conducive to their growth, a reduction of nearly 20 per cent. in the stand is to be expected even in seasons favourable to the hosts. Late spring sowings are more liable to infection than those made in the autumn, which germinate before the rise in soil temperature and thus escape injury.

Smith (C. O.). **Crown gall on species of Taxaceae, Taxodiaceae, and Pinaceae, as determined by artificial inoculations.**—*Phytopathology*, xxxii, 11, pp. 1005–1009, 3 figs., 1942.

Continuing his inoculation experiments with pure cultures of *Phytomonas* [*Bacter-*

ium] *tumefaciens* on conifers at Riverside, California [*R.A.M.*, xix, p. 389], the writer secured gall development on nursery trees of *Podocarpus elongata*, *Taxus baccata* var. *erecta*, *T. brevifolia*, *T. media*, and *Torreya californica* (Taxaceae); *Cunninghamia lanceolata*, *Sequoia gigantea*, *S. sempervirens*, and *Sciadopitys verticillata* (Taxodiaceae); and *Abies cephalonica*, *A. concolor*, *A. firma*, and *A. holophylla* (Pinaceae).

Kaufert (F. H.) & Behr (E. A.). **Susceptibility of wood to decay. Effect of urea and other nitrogen compounds.**—*Industr. Engng Chem.*, xxxiv, 12, pp. 1510–1515, 1942.

Urea or carbamide is being increasingly used in the United States as a chemical seasoning agent for timber, while other nitrogenous compounds, notably ammonium sulphate and ammonium phosphate, are largely employed for fire-retardant or flame-proofing purposes. Concern having been expressed as to the possible stimulation of fungal decay by these substances, experiments were carried out at the University of Minnesota to determine their effects on the rate of rotting of loblolly pine (*Pinus caribaea*) sapwood and the heartwoods of cypress, red oak (*Quercus borealis* var. *maxima*), and Douglas fir [*Pseudotsuga taxifolia*] by malt agar cultures of *Lenzites trabea*, *Lentinus lepideus*, *Poria incrassata*, and *Trametes serialis*, the oak samples being additionally inoculated with *Daedalea quercina* and those of Douglas fir with an unidentified wood-rotting fungus designated RS. In small amounts the compounds either failed to accelerate the normal course of decay, or their influence in this direction was so slight as to be negligible from a practical standpoint, whereas at higher concentrations of 1 per cent. and upwards (1 to 1·5 per cent. urea corresponds to the recommended minimum of 40 lb. per 1,000 board ft.), they caused marked reductions in the incidence of infection, judged by the percentage loss of weight after three months' exposure to the pathogens, urea and ammonium sulphate being particularly active in this respect. Low concentrations of asparagin and peptone increased the velocity of decay in the pine and oak samples, but exerted little or no effect on Douglas fir: cypress contracted no measurable degree of infection throughout the period of the trials.

The addition of peptone agar suspensions of soil bacteria to the urea-treated Douglas fir samples did not substantially enhance their susceptibility to fungal decay, but more extensive tests are necessary before final conclusions can be drawn regarding this aspect of the investigations.

Heating urea-treated Douglas fir wood to 70° to 100° C. for 12 to 14 hours induces considerable decomposition and loss of urea, but a certain amount of the compound becomes fixed and is only removed with difficulty by leaching. Otherwise the nitrogenous substances readily disappear under conditions favouring leaching, and a standard preservative treatment should probably be applied to wood thus treated where risk of decay is anticipated.

Wenzl (H.). **Ist die Bespritzung der Blattunterseiten bei Bekämpfung der Cercospora-Blattfleckenkrankheit der Rübe notwendig?** [Is it necessary to spray the under surface of the leaf in controlling *Cercospora* disease of Beet?] —*Z. PflKrankh.*, li, pp. 20–24, 1941. [Abs. in *Ital. agric.*, lxxix, 6, pp. 330–331, 1942.]

In experiments carried out during 1939 in three different localities between the upper and lower reaches of the Danube beet leaves were sprayed (1) on both surfaces, (2) on the under surface only, and (3) on the upper surface only with a copper oxychloride preparation containing 15 per cent. copper at a concentration of 1·5 per cent., applications being made at the rate of 700 l. per ha. at intervals of three weeks from the end of June until 20th August [*R.A.M.*, xviii, p. 721].

Infection by *Cercospora* [*beticola*] appeared after the second spray treatment. In October, it was found that the unsprayed control plots were severely affected, whereas the treated plots showed only very light infection. Applications of spray only to the

under surface of the leaf were clearly less effective than applications to the upper side alone, or to both surfaces. In general, spraying the upper surface alone was at least as effective as spraying both sides.

Kendrick (J. B.) & Snyder (W. C.). **Fusarium wilt of Radish.**—*Phytopathology*, xxxii, 11, pp. 1031–1033, 1942.

Fusarium oxysporum f. *raphani* n.f. is the name applied to the pathogen responsible for the vascular wilt of White Chinese Winter radishes (*Raphanus sativus* var. *longipinnatus*) in California, reference to which has already been made [*R.A.M.*, xv, p. 548]. Of the eight radish varieties used in inoculation experiments, only Chinese Rose Winter and French Breakfast gave any evidence of resistance with 25·5 and 35·3 per cent. infection, respectively, compared with 90·3, 87·8, 85·8, 79·6, 75·8, and 71 for California Mammoth White, White Chinese Winter, White Icicle, Scarlet Turnip, Long Scarlet, and Long Black Spanish, respectively. Early Jersey Wakefield cabbage and Jersey kale showed no infection.

Sharvelle (E. G.), Young (H. C.), & Shema (B. F.). **The value of spergon as a seed protectant for canning Peas.**—*Phytopathology*, xxxii, 11, pp. 944–952, 4 graphs, 1942.

In 1940 and 1941, when root rots of peas (*Rhizoctonia* sp., *Fusarium martii* var. *pisi*, and *Aphanomyces euteiches* in the former year, and a species of *Pythium* in the latter) assumed epidemic proportions in southern Minnesota, experiments were carried out to determine the relative value of different seed treatments in the control of these pathogens. In 1940 spergon [*R.A.M.*, xxi, pp. 511, 515], applied at the rate of 2 oz. per bush., produced an average increase in stand of 23 per cent., comparable results being obtained with new improved ceresan, used in one test, while nitrogen inoculation with a bacterial gel gave a surplus over the control plots of 10 per cent. The average increase in the yield of green, shelled peas due to the spergon treatment in 1940 was 357 lb. per acre or 18 per cent. over the untreated lots of seed. The average reduction in root-rot infection in the spergon-treated plots amounted to 44 per cent., the corresponding figure for new improved ceresan being 47. The outcome of the 1941 trials with spergon showed an increase in yield of 13·9 per cent. over the untreated, but no increase in yield was obtained from this treatment in combination with nitrogen inoculation. Spergon appears to exert a definite stimulus on root growth.

Kligman (A. M.). **Control of fungi in Mushroom casing soil by sterilization.**—*Phytopathology*, xxxii, 11 pp. 978–985, 1 fig., 1942.

At the Pennsylvania State College the spores of *Mycogone perniciosa*, *Verticillium malthousei* [*R.A.M.*, xiii, p. 286; xix, p. 516], and *Dactylium dendroides* in mushroom [*Psalliota* spp.] casing soil were destroyed by chloropicrin at the rate of 2 ml. per cu. ft., and the same compound at a concentration of 3 ml. per cu. ft. gave satisfactory results in roughly constructed wooden bins, 11½ by 9 by 3 ft., erected on the composting ground at the back of the mushroom houses. In two field plots, 6 ft. square, 3 ml. of the chemical were injected to a depth of 3 in. into the centre of each 1-ft. square, one plot being covered with canvas and the other left uncovered; the soil from the former yielded disease-free mushrooms, the latter 35 per cent. infected, and the untreated soil infected mushrooms on emergence. The treated plots were sprinkled with water before covering with canvas, the edges of which were buried in the soil, to prevent the escape of the gas. The crops grown on the chloropicrin-treated soil were comparable with those obtained from plots sterilized with formalin and steam. The use of chloropicrin for the fumigation of empty houses was found to be uneconomical.

Daines (R. H.). **Sweet Potato pox.**—*Circ. N.J. agric. Exp. Sta.*, 437, 8 pp., 1942. [Abs. in *Hort. Abstr.*, xii, 4, p. 214, 1942.]

Actinomyces ipomoea, the agent of sweet potato pox [*R.A.M.*, xx, p. 320], thrives

only in alkaline soils, directions for the acidification of which by means of sulphur are given. In soils known to be infested by the pathogen efforts should be made to maintain the hydrogen-ion concentration at P_H 4·4 to 5 for sweet potato cultivation, without appreciable deviations in either direction.

Fernando (M.) & Udurawana (S. B.). **The nature of the mosaic disease of Bandakka (Hibiscus esculentus L.).**—*Trop. Agriculturalist*, xcviii, 1, pp. 16–24, 2 pl., 1942.

The most prominent symptom of the prevalent mosaic of *Hibiscus esculentus* [cf. *R.A.M.*, xx, p. 242] in the Matale district of Ceylon, where the host is grown as part of a mixed crop with cowpeas and cucumbers, is a yellow veinbanding of the leaves, sometimes accompanied by interveinal buckling and minute enations on the abaxial side of the net veins. Occasionally the entire leaf surface may assume a chlorotic tinge. The fruits of diseased plants are dwarfed and malformed, often presenting excrescences at their distal ends, and with a tendency to chlorosis where the normal coloration is dark green.

The volume of evidence provided by statistical analyses of records of disease incidence indicates that the mosaic is infectious, and its transmission by the patch-budding of scion material from chlorotic to healthy plants definitely points to a virus as the pathogenic agent. Under field conditions an insect is presumably responsible for the spread of the mosaic, which was experimentally shown not to be seed-borne. The most practicable method of control would appear to lie in the roguing of affected plants and such potential hosts of the virus as *Ageratum conyzoides*, *Vernonia cinerea*, and *Emilia javanica*.

Wissenschaftlicher Jahresbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, 1940. [Scientific Annual Report of the National Biological Institute for Agriculture and Forestry, 1940.]—*Mitt. biol. Anst.* (*Reichsanst.*), *Berl.*, 65, 1941. [Abs. in *Z. PflKrankh.*, lii, 11, pp. 513–516, 1942.]

Further items of phytopathological interest are cited from the above-mentioned report [cf. *R.A.M.*, xxii, p. 90]. H. Richter (pp. 12–13) found that the refuse of diseased plants left over from the harvest and contaminated stable manure are the principal sources of perpetuation of lupin wilt (a form of *Fusarium oxysporum*) [ibid., xviii, p. 832]. *Verticillium albo-atrum*, hitherto restricted to the perennial lupin in Holland, was observed in Germany on *Lupinus polyphyllus*, *L. albus*, and *L. mutabilis*. *L. albus* was further attacked by *Botrytis cinerea* and *F. avenaceum*, the latter causing a hitherto undescribed pod rot.

Pythium de Baryanum was shown by H. Schultz (pp. 13–14) to be of great importance as an agent of foot rot in blue [*L. angustifolius*] and white lupins [ibid., xix, p. 282], other species of minor significance isolated from which include *P. intermedium*, *P. polymorphon*, *P. irregulare*, *P. mamillatum*, and *P. artotrogus*. Six out of 11 strains of *Rhizoctonia* [*Corticium*] *solani* isolated from foot-rotted plants proved to be pathogenic to lupins [ibid., xviii, p. 832]. *Sclerotinia sclerotiorum*, present on foot-rotted lupins in the field, caused infection only of the above-ground portions in inoculation tests. Emergence of the blue lupin may be reduced by an abundance of *Botrytis* [*? cinerea*] inoculum. *Thielavia* [*Thielaviopsis*] *basicola* [ibid., xvi, p. 539] is particularly injurious to the white lupin.

H. Pape's observations on *Alternaria brassicae* on rape (pp. 80–81) showed that spore dissemination is effected chiefly by the wind; seed transmission, though not impossible, is devoid of practical importance.

[O.] Schlumberger's tests (p. 18) on the reaction to wart disease [*Synchytrium endobioticum*] of 67 potato varieties under observation by the Reich Food Board [ibid., xix, p. 564] showed that 17 were either immune or resistant in varying degrees.

K. O. Müller's studies (pp. 25–26) on the development of resistance to *Phytophthora infestans* in potatoes [ibid., xxi, p. 501], extending over a period of 15 years, have been brought to a conclusion for the time being. Several of the medium-early, medium-late, and late varieties tested in 1940 proved to be resistant to physiologic race A of the fungus and in other respects also well worthy of cultivation. The problem of breeding varieties resistant to the other races, however, remains to be solved. *P. infestans* appears to be seldom, if ever, transmitted by seed potatoes.

R. Griesinger found (pp. 27–28) that the residual (non-albuminous) nitrogen content of *Phytophthora*-diseased potato tubers is appreciably diminished in relation to that of albuminous and more especially of protein nitrogen. No relationship was found between the non-albuminous nitrogen content and resistance.

L. Rohrer ascertained (p. 86) that under the climatic conditions of the Ostmark copper oxychloride preparations must be used at concentrations at least twice as strong as Bordeaux mixture to produce comparable results against vine downy mildew (*Plasmopara viticola*). In experiments by H. Zillig and L. Niemeyer 0·5 per cent. Bordeaux mixture conferred adequate protection against mild cases of the disease in dry weather.

The results of field trials carried out by Langenbuch and Heiling (pp. 63–64) showed that the resistance of raspberries to cane blight (*Didymella applanata* and *Coniothyrium* [*fuckelii*]) is enhanced by the application to the soil of humus, potassium, and phosphoric acid, and decreased by heavy nitrogenous manuring.

Inoculation experiments by H. W. Wollenweber and K. Röder (p. 48) with *Graphium* [*Ceratostomella*] *ulmi* on a dozen elms of the Christine Buisman variety failed to induce a trace of infection [ibid., xvii, p. 636]. Within the old focus of infection at Feldkirch, Vorarlberg (Ostmark), *Phaeocryptopus gaeumanni* was detected on the green [*viridis*] form of Douglas fir (*Pseudotsuga taxifolia*) [ibid., xvii, p. 714].

Voelkel (H.). **Die wichtigsten Krankheiten und Schädlinge der landwirtschaftlichen Kulturpflanzen im Jahre 1941.** [The most important diseases and pests of agricultural cultivated plants in the year 1941.]—*Beil. NachrBl. dtsch. PflSchutzDienst*, xxii, 2, 20 pp., 1942. [Abs. in *Zbl. Bakt.*, Abt. 2, cv, 12–13, p. 238, 1942.]

This report, compiled on the usual lines, on the incidence of plant pests and diseases in Germany during 1941 [cf. *R.A.M.*, xviii, p. 436], is preceded by brief preliminary observations on injuries of meteorological origin and accompanied by 46 maps serving to illustrate the text and facilitate a rapid survey of the extent of the various disorders.

Department of Botany.—*Rep. Ont. agric. Coll., 1941*, pp. 44–48, 1942.

The following items of phytopathological interest occur in this report. Of 12 barley varieties inoculated with loose smut [*Ustilago nuda*] in 1940, the seed-grain being sown in the following year, Trebi was the only one to exhibit complete immunity, the incidence of infection among the remainder ranging from 1 per cent. in O.A.C. No. 21 to 18 per cent. in White Hulless. A definite correlation appears to exist between the degree of susceptibility to *U. nuda* and looseness of hull on the ripe grain. Renown, Regent, and Reward were the most susceptible of seven spring wheats tested for their reaction to loose smut [*U. tritici*], the last-named showing 18 per cent. smutted heads, while of the four winter varieties, Dawtas and Junior No. 6 proved to be resistant, while Dawson's Golden Chaff and Dawbul were very susceptible.

The first case of 'X' disease of peaches and chokecherries [*Prunus virginiana*: *R.A.M.*, xxii, p. 10] in the Niagara Peninsula was diagnosed on 25th July, 1941, but there is reason to believe that it had already been present in some orchards (mostly

in the Bartonville district in the western section of the region under inspection) for as long as four years.

Two applications of cuprocide gave very satisfactory control of tomato leaf spot [*Septoria lycopersici*] in three comparative experiments in different parts of Ontario.

Brown heart of Laurentian turnips was effectively combated by spraying with a saturated aqueous solution of borax with the addition of 0·25 per cent. orvus.

Extensive destruction of greenhouse stocks [*Matthiola incana*] was caused by root rot and stem blight (*Rhizoctonia*) [*Corticium solani*: ibid., xx, pp. 168, 582], infection by which may be prevented by soil sterilization with steam or formalin, or renewal by the removal of the old soil to a depth of 10 in. and its replacement with fresh material not previously used for ornamentals. Another wise precaution consists in 30 minutes' immersion of the seed in a 0·1 per cent. mercuric chloride solution, followed by washing in water.

Veitch (R.). **Report of the Director of Plant Industry (Research).**—*Rep. Dep. Agric. Qd 1941–1942*, pp. 5–8, 1942.

In this report [cf. *R.A.M.*, xxi, p. 183] the author states that the five-year programme of work in Queensland on tomato diseases and their control by spraying and dusting was completed late in 1941. The insoluble copper compounds tested were as effective as Bordeaux mixture, and had the advantage of not reducing yield. As regards dusts, both basic copper carbonate with kaolin and dehydrated copper sulphate with hydrated lime gave effective disease control. When disease is present in epidemic proportions, spraying may be more effective than dusting, which also entails more numerous applications than spraying; but when only average infection prevails, dusting is as effective as spraying, besides being easier to carry out.

A survey of maize diseases on the Atherton Tableland showed the most important to be the ear rots, which were most commonly caused by *Diplodia* spp., *Gibberella zeae*, *Fusarium* spp., and *Basisporium* [*Nigrospora*] sp. Smut (*Sorosporium reilianum*) [cf. ibid., xvii, p. 519] caused loss on a few farms.

Lucerne in parts of the Atherton Tableland is affected by a stem anthracnose caused by a species of *Vermicularia* [*Colletotrichum*: ibid., viii, p. 268; xi, p. 545]. Incidence appears to be closely related to rainfall and soil acidity.

The occurrence of mouldy balls in silage was investigated. It was ascertained that, where the rate of consumption is slow, air percolates to a depth of 6 in. into the silage, and favours the growth of aerobic fungi. If the silage is used up at the rate of 6 in. daily, the trouble should cease.

A disease which rapidly killed Bathurst burr [*Xanthium*] in several localities in 1942 may, it is thought, prove to be of value in the control of this weed. However, because of late rains, the plants were young and were growing rapidly during the cool, wet weather experienced towards the end of the summer, so that some of the conditions that may have influenced the disease were not altogether typical. A species of *Colletotrichum* was isolated from the infected plants, experimental inoculations with which produced characteristic symptoms.

Baker (R. E. D.). **Witches' broom disease investigations III. Notes on the occurrence of witches' broom disease of Cacao at River Estate, 1939–1942.**—*Trop. Agriculture, Trin.*, xx, 1, pp. 5–12, 1943.

In the course of further studies on the witches' broom disease of cacao in Trinidad [*Marasmius perniciosus*: *R.A.M.*, xxii, p. 128] disease records were taken from September, 1939, to September, 1942, at River Estate, Diego Martin, on a plot of eight-year-old trees, 76 representing the open-pollinated seedling progeny of the selection I.C.S. 1. The disease is stated to have increased in severity and by 1942 severely damaged and rendered unproductive several trees on this property; yet it is believed that the disease has not yet reached its maximum intensity. At the same time,

the effect of the extremely dry seasons of 1941 and 1942 made it impossible to distinguish between the amount of damage caused by drought and that caused by witches' broom. By October, 1942, the preceding months having been abnormally wet, the incidence of the disease was already nearly double that present twelve months earlier and as high as the previous year's maximum, which occurred in December, 1941–January, 1942. The rate of production of sporophores, on which the intensity of the disease largely depends, having, in addition, become already very high, it was assumed that the disease situation would be worse still by January, 1943.

The trees were found to vary greatly in the number of brooms removed, but it was consistently observed that trees which produce many brooms (both the fan and the cushion types) one year are likely to do so again the next year, and that trees which produce only a few brooms one year are likely to do so again the next year. Close correlation was found to exist between cushion brooms and flower production, but none between fan-brooms and flush or between cushion-brooms and fan-brooms. It is concluded from these data that if there is a resistance to the disease in Trinidad cacao, it is unlikely to be an inherent protoplasmic one but more probably one based on some form of disease avoidance on the part of the tree. It is suggested that some purely morphological character might account for the resistance, and that a tree showing resistance to fan-brooms might show no comparable resistance to cushion-brooms or to pod infection. Very few data have as yet been collected on the question of pod resistance. It is emphasized, nevertheless, that even trees showing resistance to fan-brooms only would be of considerable value in combating the disease. Incomplete data collected during the last year of the present study showed that only 10 per cent. of the pods were attacked by witches' broom disease, the bulk of the crop having escaped infection because the majority of the pods had developed during dry weather when the disease was at a minimum. This advantage is, however, offset by the fact that dry season pods may be 25 to 50 per cent. smaller than those ripened in the wet season. There was no indication of a correlation between the number of diseased pods and either the total number of brooms or the number of cushion-brooms per tree. Records of sporophore formation showed that a positive correlation exists between the sporophore index (the number of sporophores produced by a random sample of 100 brooms) for a given week and the total number of brooms formed five weeks later, thus indicating strongly that the supply of spores is a major controlling factor in this disease.

Andrén (F.). **Resultat från betningsförsök 1941.** [The results of disinfection experiments 1941.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, *1942*, 4, pp. 60–63; 5, pp. 70–72, 1942.

The results of cereal seed-grain disinfection experiments in Sweden in 1941, which were conducted on a similar scale to those of 1940 [*R.A.M.*, xix, p. 462], are summarized and tabulated. The average yield increases in the winter wheat crop from dusting, immersion, and sprinkling were 180, 145, and 145 kg. per ha., respectively. Bunt [*Tilletia caries* and *T. foetida*] was reduced to a minimum by most of the treatments, the average efficiency of which is rated at 99·6 per cent., among the best being fusariol 2948, betoxin 61, abavit-neu, and panogen dusts, the three first-named at 200 and the last at 175 gm. per kg., and uspulun, abavit, and germisan solutions (all at 0·125 per cent.). The average efficiency of the various preparations in the control of barley stripe [*Helminthosporium gramineum*] was computed at 97 per cent., absolute freedom from infection having been secured by 15 minutes' immersion in 0·125 per cent. fusariol 2115. Betoxin 61 and fusariol 2948 (300 gm. per kg.) were among the most effective of the preparations tested against loose smut of oats [*Ustilago avenae*]. On the other hand, conflicting results

were obtained in the trials with abavit-neu and [ceresan] U.T. 1875 b., hitherto completely reliable in the control of this disease.

Dickson (J. G.). **Scab of Wheat and Barley and its control.**—*Fmrs' Bull. U.S. Dep. Agric.* 1599, 22 pp., 15 figs., 4 maps, 1942.

In this revised edition of a bulletin originally issued in 1929 [*R.A.M.*, ix, p. 172] the author states that in 1919 [in the United States] scab (*Gibberella saubinetii* [*G. zeae*]) caused losses to wheat alone estimated at about 80 million bush. The disease was destructive again in 1928 and 1935, especially to spring wheat and spring barley. In other years heavy damage has been incurred in local areas, notably in Illinois, Iowa, southern Wisconsin, southern Minnesota, and south-eastern South Dakota, as well as in Maryland, Virginia, and North Carolina. The disease is present from the Mississippi Valley eastward in greater or less abundance every year, while it is rare or absent in the semi-arid plains and inter-mountain districts. Along the northern border the temperatures are usually less favourable for attack than in the central parts. In wet seasons it frequently spreads westward into the prairies. Wheat losses are highest in the soft winter-wheat area. Barley losses are greatest in the more humid, southern parts of the spring-barley area. In addition to the severe losses in 1928 and 1935 local losses occurred in this area in every year, except during the drought years of 1934 and 1936. In years such as 1928, when spring barley was used to replant fields in which wheat had succumbed to winter injury, losses were often very high. Losses in maize and rye are sometimes heavy, but, in general, losses in oats are low.

Affected grain can be fed safely to cattle, sheep, and chickens, but not to pigs. Horses will not eat badly scabbed grain, and it should not be used in human food. As infected wheat or rye kernels can be removed by suitable cleaning machinery, scab in these grains is less objectionable than in barley.

The disease develops most readily in warm, moist weather. A warm, comparatively dry soil favours the development of the seedling blight stage on wheat, barley, rye, and oats, while a cold, dry soil favours it on maize.

Losses can be greatly reduced by cleaning up the crop residues or ploughing them under, crop rotation, and the use of resistant varieties and disease-free and treated seed.

Gorlenko (M. V.). **Modes of hibernation of mildew (Erysiphe graminis D. C.) on cereals.**—*C. R. Acad. Sci. U.R.S.S.*, N.S., xxxv, 6, pp. 187–188, 1942.

In studies conducted in the Voronezh district from 1937 to 1941 it was found that different forms of *Erysiphe graminis* from different cereal hosts vary in their mode of hibernation. Thus, *E. g. tritici* overwinters on winter wheat plants in the form of brown cushions of mycelium. *E. g. hordei* similarly overwinters on winter-sown barley, and the area of injurious activity of this form is, therefore, associated with regions in which winter barley is grown on a large scale. *E. g. bromi*, a strictly specialized form attacking only *Bromus arvensis*, overwinters by means of numerous perithecia, thus adapting itself to the winter behaviour of its host, an annual plant with a short growing season. *E. g. agropyri* overwinters in the form of mycelium on *Agropyron repens*. *E. g. poae* was observed to form only the conidial stage on *Poa pratensis* and *P. silvestris*, migrating in the autumn to the rosettes, which outlive the winter, and hibernating on them, whereas on *P. bulbosa*, which dies by the end of summer, the fungus produced large numbers of perithecia. *E. g. dactylidis* overwinters on *Dactylis glomerata* in the form of mycelium in mild winters and in the form of perithecia in severe ones. It is concluded from these observations that the different forms of *E. graminis* differ not only in host range but also in their mode of hibernation, that their mode of hibernation is adapted to the biological peculiarities of the host plant, and that they tend to spend the shortest possible

time apart from the living tissues of the host. For instance, the ascus stage is absent from hosts which live through the winter, but develops rapidly and abundantly on hosts with a short growing season. On account of the existing differences in specialization and biology between the forms studied, it is suggested that the mixed species *E. graminis* be subdivided into several.

Bose (A. B.). **Germination of ergot.**—*Curr. Sci.*, xi, 11, p. 439, 1 fig., 1942.

In sterilized moist sand in Petri dishes at 20° C. four sclerotia of *Claviceps purpurea* imported from Europe (ergot being unobtainable in India) were germinated at the Carmichael Medical College, Calcutta. In subsequent experiments under similar conditions with the species of *Claviceps* collected in the Simla Hills by P. Nath [*R.A.M.*, xxi, p. 206], one sclerotium germinated after seven days, bearing on a slender, yellowish stalk a stroma containing mature perithecia with asci and filiform ascospores, the further development of which could not, however, be followed up.

Innovations in spray apparatus.—*Calif. Citrogr.*, xxviii, 3, p. 61, 5 figs., 1943.

As a result of the war-time labour shortage Californian citrus-growers are making increased use of mechanized spraying devices, including a mechanically oscillating straight boom, a 15-nozzle oscillating angular boom, semi-stationary 3- or 4-nozzle boom attachments for skirt spraying, and a movable boom, operated from the driver's seat, in which three nozzles revolve. It is stated to be too early to compare the results of these experimental machines with ordinary spray rigs.

Parker (E. R.) & Southwick (R. W.). **Manganese deficiency in Citrus.**—*Proc. Amer. Soc. hort. Sci.*, xxxix, pp. 51–58, 1 fig., 1941.

This is a survey of the available information on manganese deficiency of citrus in California, most of which has already been noticed from other sources [*R.A.M.*, xix, p. 338]. Except in the case of very severely affected orange and grapefruit trees, which had undergone premature defoliation, there was no obvious improvement during a two-year experimental period in the health or yield of trees in which leaf symptoms of manganese deficiency were eliminated by spraying with manganese mixtures. The admixture in the spray of soda ash (a hydrated lime), in quantities equivalent to half the weight of manganese sulphate used, is advocated to prevent leaf burning, and it was found that sprays containing about 3 lb. manganese sulphate per 100 gals. water were as effective as more concentrated mixtures.

Barducci (T. B.) & Rada (G. G.). **El Verticillium-wilt del Algodonero.** [The *Verticillium* wilt of Cotton.]—*Bol. Estac. exp. agríc. La Molina* 23, 46 pp., 16 figs., 4 graphs, 1942.

The species of *Verticillium* responsible for cotton wilt in Peru [*R.A.M.*, xix, p. 263; xxi, p. 517] has been determined as *V. albo-atrum*, the optimum temperature and hydrogen-ion concentration for which in cultures on Czapek's, potato dextrose, and potato peptone dextrose agars were found to be 22° C. and P_H 7, respectively. The pathogen, which produces a systemic disease in its host, may easily be isolated from fresh material, the tips of the plant and of the branches and the secondary rootlets yielding the maximum percentages of fungal colonies (43·7, 59·5, and 43·4, respectively, compared with 34·3, 26, and 6·2 for the petioles, boll peduncles, and tap-root, respectively).

Deschiens (R.). **Milieux de culture à rendement élevé pour la récolte des spores d'Hyphomycètes prédateurs de Nématodes.** [Culture media for the production of heavy crops of the spores of Hyphomycetes preying on Nematodes.]—*Bull. Soc. Path. exot.*, xxxv, 6–8, pp. 237–241, 1942.

Details are given of the preparation and utilization of two substrata which have

produced luxuriant yields of spores of the species of *Arthrobotrys*, *Dactylella*, *Dactylaria*, and *Stylopage* preying on nematodes of the genera *Rhabditoidea*, *Strongyloidea*, *Trichostrongyloidea*, and *Metastrongyloidea*, parasites of man, animals, and cultivated plants [*R.A.M.*, xix, p. 149]. One is composed of 5 gm. each of oats chaff and malt extract, 12 to 15 gm. agar, and 1,000 c.c. distilled water (P_H 5·4 to 5·6), and the other of the same ingredients minus the chaff. At a temperature of 25° C., an abundant crop of spores is produced on the former medium in 60 to 80 days and on the latter in 80 to 100: the period of viability is one year. Before application in powder form to the soil or compost heap, the spores are dried in the open air or at 37°. To be effective, the powdered inoculum must be applied at the rate of 5 to 10 gm. per sq.m. soil, this being the approximate yield of a quarter of a Roux tube. The author envisages the extended use of predatory fungi for the prophylaxis of human and animal helminthiases and plant eelworms.

Farrell (W. A.). **Bronchomoniliasis.**—*Canad. med. Ass. J.*, xlviii, 1, pp. 28–30, 2 figs., 1943.

The yeast-like fungus isolated from cultures of the sputum of a 23-year-old gold-miner suffering from an obscure pulmonary disease at Fort William, Ontario, fermented glucose, levulose, arabinose, and maltose (slightly), evolved acid from milk, which was coagulated, but did not liquefy gelatine. On the basis of these biological characters the organism was identified as *Monilia nabarroi* Cast.

Sampson (B. F.) & Farren (J. E.). **Another case of Torula meningitis.**—*S. Afr. med. J.*, xvi, 13, pp. 245–247, 5 figs., 1942.

A point of mycological interest, believed to be here recorded for the first time, in connexion with the third case of meningitis due to *Torula histolytica* [*Debaryomyces neoformans*] in South Africa [*R.A.M.*, xix, p. 536], is the occurrence of the torules in family units or groups, united by mucoid material surrounding the older cells, the proximal part of which takes the Gram stain and is surrounded by an orange halo. The youngest members of the family stain Gram-positive and resemble a watermelon seed in shape; they grow readily on maltose or even on plain agar, but the cells produced under artificial conditions are not provided with the mucoid coats observed in the natural state.

Schenken (J. R.) & Palik (E. E.). **Coccidioidomycosis in States other than California, with report of a case in Louisiana.**—*Arch. Path.*, xxxiv, 3, pp. 484–494, 1 fig., 1942.

A feature of special interest in this report of a case of coccidioidal granuloma (*Coccidioides immitis*) in a 33-year-old negro of New Orleans, who is believed to have contracted the disease while picking fruit in California, is the exceptionally large dimension of the spherules, averaging 25 to 75 μ and reaching a maximum of 262 μ in diameter; the endospores measured 11 to 38 μ.

The geographical distribution of coccidioidomycosis is discussed and a table given showing particulars of the occurrence of 27 cases in States other than California.

Dillman (A. C.). **Breeding Flax resistant to rust.**—*Oil Paint Drug Rep.*, cxlii, 17, pp. 4, 40 B, 1 fig., 1942.

Despite heavy damage by rust [*Melampsora lini*], the 1942 United States flax crop was the largest on record, being estimated at 42,500,000 bush. In some localities the disease caused a reduction of 50 per cent. and upwards in output of the susceptible Bison, which in a comparative test of 25 varieties at Fargo, North Dakota [*R.A.M.*, xxi, p. 418] yielded only 13 bush. per acre as against a harvest

of 21 to 27 bush. from 18 new resistant types. Another undesirable feature of Bison is the inferior drying quality of its oil (low iodine number), and efforts are being made at the Minnesota, North Dakota, and Montana Agricultural Experiment Stations to overcome this and other defects by breeding. Several new strains combining superior oil quality with resistance to *M. lini* have, in fact, been developed, but, since the seed of these varieties will not be available for commercial cultivation in 1943, growers should procure the best sorts at present on the market, e.g., Viking, and (especially if the use of Bison is unavoidable) observe such sanitary precautions as thorough cleansing of the seed, the ploughing-under or burning of loose straw or standing stubble, crop rotation, planting old seed (1940 or 1941), which is unlikely to harbour viable spores of the rust, and early sowing. The spread of *M. lini* is liable to be arrested by a spell of dry weather with daily temperatures above 85° F., but in 1942 the prevailing rainy and cool conditions favoured the pathogen.

Colhoun (J.) & Muskett (A. E.). **'Pasmo' disease of Flax.**—*Nature, Lond.*, cli, 3825, pp. 223–224, 2 figs., 1943.

When flax plants in the flowering stage were sprayed with a spore suspension of a fungus resembling *Sphaerella linorum* sent from Kenya [I.M.I. Map 18], by Nattrass, who stated that the fungus had been isolated from flax plants suspected of being attacked by 'pasmo' disease, lesions characteristic of this disease appeared on the plants 14 days later. The organism was re-isolated from pycnidia produced on the lesions, and was again inoculated into healthy flax, positive results again being obtained, and the organism again being re-isolated. Infection resulted from inoculations made both under glasshouse and open-air conditions.

The lesions produced appeared on leaves and stems, chiefly on the upper portions of the plants, and were brown, small, elongated, extending only part of the way round the stem; later on they enlarged and encircled the stem. Diseased and healthy portions commonly alternated on one and the same stem. The part above the encircling lesions was often killed by 'strangling'. In some instances the stem lesions somewhat resembled those produced by *Polyspora lini*, but the production of pycnidia in the case of 'pasmo' disease is sufficient to distinguish it. The minute, cream-coloured, acervuli produced by *P. lini* are not often found in the field, but are readily produced when infected stems are incubated.

As 'pasmo' disease has not yet been found in Great Britain, the utmost care must be taken to ensure that imported flax seed is uncontaminated.

Schönleber (K[lara]). **Untersuchungen über den zerstörenden Einfluss von Mikro-organismen auf verschiedenartig gelagerte künstliche Fasern.** [Investigations on the destructive influence of micro-organisms on synthetic fibres stored under varying conditions.]—*Zellwolle–Kunstseide–Seide*, xlvi, 9, pp. 336–342; 10, pp. 386–399, 37 figs., 1941. [Abs. in *Holz Roh- u. Werkstoff*, v, 9, p. 331, 1942.]

All kinds of synthetic fibres stored in a saturated atmosphere (100 per cent. atmospheric humidity) but not in one of 65 per cent. humidity are liable to disorganization by bacteria and fungi, the latter represented chiefly by *Aspergillus* and *Penicillium* spp. [*R.A.M.*, xx, p. 588], this group of organisms being mainly responsible for the destruction of fibres manufactured from cellulose, whereas bacteria play a more prominent part in the disintegration of material prepared from casein.

Ashworth (D[orothy]). **A Papulaspora-like fungus from Tulip bulbs.**—*Trans. Brit. mycol. Soc.*, xxv, 4, p. 441, 1942.

The author records the occurrence of a *Papulaspora* isolated from tulip bulbs at

the Royal Horticultural Society's Laboratory at Wisley some 15 years ago. No evidence of pathogenicity was obtained at the time. Reasons were advanced for placing the fungus in the genus *Papulaspora*, but no specific name was suggested.

Fischer (R.). **Der Lackschorf der Gladiole.** [The lacquer scab of Gladiolus.]—*Kranke Pflanze*, xix, 7–8, pp. 73–75, 1942.

This is a popular note on the three forms of disease associated in Germany and Austria with the infection of gladiolus by *Bacterium marginatum*, viz., 'lacquer scab', the name applied to the brown, cup-shaped depressions with a rubbery coating on the corms, 'brown pustules' on the foliage, and 'foot rot' of the basal leaves. Of these, the 'brown pustule' phase is promoted by heavy rainfall or injudicious watering, while damp, heavy soils are conducive to 'lacquer scab' and 'foot rot', of which the latter is the more serious and terminates fatally, whereas diseased corms, transferred to a dry site, may give rise to completely healthy 'daughter' corms. The corms developing from foot-rotted plants should be lifted from the soil and burnt or buried in deep pits with an admixture of caustic lime, while other precautions against the spread of infection should include a regular change of planting site, the use of healthy corms, the removal of infected parts with a knife, overwintering of the corms in a fairly dry atmosphere, and their antiseptic treatment for 30 to 60 minutes in an emulsion of a standard fungicide, such as 0·5 per cent. mercuric chloride mixed with 0·5 kg. loam per l., before being laid out to dry.

Stuart (N. W.) & McClellan (W. D.). **Severity of Narcissus basal rot increased by the use of synthetic hormones and nitrogen bases.**—*Science*, N.S., xcvii, 2505, p. 15, 1943.

During the past two years investigations have been carried out at the Bureau of Plant Industry Station, Beltsville, Maryland, in which King Alfred narcissus [daffodil: *Narcissus pseudonarcissus*] bulbs were dipped before planting in the autumn in solutions containing 10 to 100 p.p.m of naphthalene acetamide, indolebutyric acid, indoleacetic acid, naphthaleneacetic acid, uric acid, guanidine, and allantoin, or in talcum powder containing 1 to 10 parts of these compounds in 5,000 parts of talcum. Several thousand bulbs were planted, and in every trial the treatment increased the amount of basal rot (*Fusarium oxysporum* f. *narcissi*) [*F. bulbigenum*]. Apparently healthy bulbs treated after harvest with several of these compounds developed a significant increase in the amount of basal rot during storage.

In laboratory studies the addition of napthalene acetamide, indolebutyric acid, allantoin, uric acid, and adenine sulphate stimulated the growth of the fungus.

This is believed to be the first report of the stimulation of a plant pathogen by a synthetic growth-regulating substance of the hormone type or by a nitrogen base. Further studies are in progress.

Smith (F. F.) & Weiss (F.). **Relationship of insects to the spread of Azalea flower spot.**—*Tech. Bull. U.S. Dep. Agric.* 798, 43 pp., 8 figs., 1942.

In studies carried out from 1934 to 1938, inclusive, infection of azalea [*Rhododendron*] by flower spot (*Orulinia azaleae*) [*R.A.M.*, xx, p. 119] was obtained through the agency of honey bees (*Apis mellifica*), five species of bumblebees (*Bombus americanorum*, *B. bimaculatus*, *B. fraternus*, *B. griseocollis*, and *B. impatiens*), two species of carpenter bees (*Xylocopa micans* and *X. virginica*), three solitary bees (*Emphoropsis floridana*, *Osmia lignaria*, and *Tetralonia rosae*), one thrips (*Heterothrips azaleae*), three ants (*Crematogaster ashmeadi*, *Pheidole morrisi* var. *vanceae*, and *Prenolepis imparis*), and a fly (*Hylemya* sp.). Infections were obtained with heads and legs of *A. mellifica*, *B.* spp., *E. floridana*, *O. lignaria*, and

X. spp., but in no instance with pollen, even when taken from infective insects and though spores were present among the pollen grains.

During the flowering periods of 1937 and 1938 the infectivity of the insects was ascertained to vary with the season. At first, the usual vectors were not present, except honey bees, and these did not produce infection, while other insects present also failed to cause disease. Primary infections developed on the flowers to the limp-blight stage before any insect gave rise to infection experimentally. As the disease became more general, the infectivity of the insects increased, reaching a maximum while the flowers were drying after a wave of general infection and the development of limp blight.

In work carried out to determine the source of primary infection, honey bees and other insects present early in the season were not found to bring the fungus from their winter quarters or from other flowers. Primary infections were most commonly present near the soil, and flowers splashed with water and soil became diseased. Soil-inhabiting animals and insects did not cause infection until after the disease had appeared in azalea gardens.

Other evidence demonstrated that an infective insect loses its spore load gradually and is able to infect at least ten flowers. Insects transmitted the disease to a distance of two miles, and marked bees were recaptured five miles away. Infection was also obtained on *R. nudiflorum*, a widely distributed native plant.

Infections caused by insects were reduced by 68·6 per cent. by means of a fungicidal dust containing 20 per cent. monohydrated copper sulphate and 80 per cent. kaolin. On the dusted flowers there were 47·6 per cent. fewer insects that caused infection. A fungicidal spray containing acetic acid only repelled insects when the flowers were wet with it.

It is concluded that although insects are sometimes effective vectors of the disease, they are not primarily responsible for its development once it has become established in a planting. They may, however, be concerned in its spread to other azalea plantings in the locality. The most sensible means of dealing with the problem would appear to consist in controlling the disease rather than the insects.

Dosdall (Louise). **How to keep disease out of the Peonies.**—*Minn. Hort.*, lxx, 8, pp. 141–142, 1942.

Practical recommendations are made for the exclusion from peony plantings of four fungal blights, all of which were troublesome in Minnesota during the continuously wet growing season of 1942, viz., *Phytophthora* [*paeoniae*], *Botrytis* [*paeoniae*], *Cladosporium* [*paeoniae*], and *Septoria* [*paeoniae*: *R.A.M.*, xv, p. 99], the three last-named being restricted to the host in question. Stringent sanitation is the most important step towards the control of all the diseases and should comprise the cutting-down of the stems in the autumn as near as possible to the buds without injuring them and burning the refuse, followed in the spring by the excision and burning of any newly infected material. Spraying or dusting with Bordeaux mixture against *P. paeoniae* should be commenced when the shoots are about 6 in. in height and repeated (under humid conditions) at weekly to ten-day intervals until the buds begin to show colour. At least two treatments should be given after the flowers are cut to prevent infection by the other three fungi, infection by which, in contrast to the *Phytophthora* blight, may occur later in the season. Attacks by *P. paeoniae* and *B. paeoniae* are often followed by root rots, which necessitate the transference of the plants to fresh sites in a sunny, airy position on well-drained soil. After division and cutting away the rotted tissues, the roots intended for re-planting should be immersed in 0·25 per cent. semesan. Another wise precaution consists in placing 2 to 3 in. coarse sand round the roots.

Castle (H.) & Nickell (L. G.). **The aerosol-hypochlorite technique for the sterilization of Orchid seeds.**—*Bull. Amer. Orchid Soc.*, xi, pp. 200–201, 1942. [Abs. in *Chem. Abstr.*, xxxvii, 1, p. 214, 1943.]

Complete sterilization of orchid seed, without injury, was achieved by the transference of a sufficient quantity of seed for one or two germination flasks to a sterilization tube by means of a small platinum loop, washing the seed to the bottom of the tube with three drops of aerosol solution (prepared by adding one drop of 25 per cent. O.T. Clear aerosol to 25 ml. water), adding three drops of freshly prepared calcium hypochlorite solution (obtained by digesting 2 gm. of the compound in 28 c.c. water for ten minutes and filtering), and stirring occasionally for five minutes.

Porter (J. N.). **Investigations on Orchid mycorrhiza.**—*Summ. Theses Ph.D. Harv., 1940*, pp. 72–74, 1942.

Three general lines were followed by the writer in his study of orchid mycorrhiza, namely (1) the germination of *Paphiopedilum* seeds, (2) the mycorrhiza of *Zeuxine strateumatica*, an account of which has already been noticed from another source [*R.A.M.*, xxii, p. 75], and (3) the associations between mycorrhizal fungi and representative orchids, including a number of Guatemalan species investigated in their native habitats in 1938.

The results of sowing *P.* seeds on Burgeff's asymbiotic medium were generally negative, but the addition of an aqueous extract from lentils tended to promote germination. Some evidence was obtained pointing to the desirability of further experiments with alcoholic vitamin extracts and on the effects of wetting and drying the seeds. Although different isolates of *Rhizoctonia repens* [ibid., xvi, p. 47], the mycorrhizal partner of *Paphiopedilum*, varied in their capacity for the promotion of germination in the orchid, and likewise hybrids of the host of diverse origin showed varying degrees of ability to utilize the fungus, the results of symbiotic tests were generally far superior to those secured on the asymbiotic substratum.

All the fungi isolated from greenhouse orchids were identified as *R. repens*, but such were the divergences in physiological activity between the several isolates that almost every hybrid of *Paphiopedilum*, for instance, harbours a 'strain' differing somewhat from the rest in this respect, but not to any significant extent morphologically.

The organisms isolated from 17 out of 72 species of Guatemalan orchids were *R. repens*, *R. gracilis*, *R. stahlii*, and two undetermined *R.* spp., the connexion between certain genera of the hosts and particular species of the fungi being consistently specific, irrespective of altitude and regional differences in habitat. *R. repens* was further isolated from the native United States orchids *Goodyera pubescens* and *Spiranthes cernua*.

Hyde (E. O. C.). **Examination of Ryegrass seed for blind seed disease.**—*N.Z.J. Agric.*, lxv, 6, pp. 349–350, 1 fig., 1942.

New Zealand growers of rye-grass [*Lolium perenne* and *L. multiflorum*] seed who desire to have their seed examined as it approaches maturity for the presence of blind seed disease [*Phialea mucosa*: *R.A.M.*, xxi, p. 455] are advised to take a sample during the week preceding cutting, at a time when the grass is not wet with rain or dew. In order that the sample may be adequately representative of the whole crop, it must consist of seed heads from many points scattered throughout the field. These heads must be tied together, labelled, rolled in paper without delay, and promptly despatched to the Seed Testing Station, Palmerston North.

Christopher (E. P.). **Influence of time of harvest on storage scald development of Rhode Island Greening and Cortland Apples.**—Abs. in *Proc. Amer. Soc. hort. Sci.*, xxxix, p. 58, 1941.

Three years' trials at the Rhode Island Agricultural Experiment Station showed that delaying the harvesting of Rhode Island Greening apples until late September and of Cortlands up to mid-October reduced the risk of storage scald in these varieties [*R.A.M.*, xxi, p. 457]. In the former, seasonal and soil fertility conditions also played a part in the development of storage scald, whereas time of harvest was the only variable factor involved with Cortland. The beneficial effects of a postponement in the picking date were chiefly apparent during the early part of the storage period.

Christopher (E. P.). **Influence of sulphur sprays on the trunk diameter of young Apple trees.**—*Proc. Amer. Soc. hort. Sci.*, xxxix, pp. 8–10, 1941.

Particulars are given of experiments to determine the comparative effects of lime-sulphur sprays, flotation sulphur paste, and sulphur dust on the trunk growth increments of McIntosh and Baldwin apples at Kingston, Rhode Island [cf. *R.A.M.*, xiii, p. 310]. In 1939 the one-year-old whips from a Maryland nursery were given four treatments, beginning on 6th June, while in 1940 five applications were made, commencing on 27th May. Scab [*Venturia inaequalis*] was almost absent in the former year but severe in the latter. In November, 1940, when the trunk diameters were measured, the girth of the McIntosh whips 1 ft. above soil-level was found to range from 1·176 in. (lime-sulphur 1 in 50) to 1·336 in. (sulphur dust), that for the untreated control being 1·226 in., the figures for the Baldwins ranging from 1·176 in. (lime-sulphur 1 in 50) to 1·368 in. (lime-sulphur 1 in 100) the control being 1·208 in., and sulphur dust 1·346 in., respectively.

Kawamura (E.). **Studies on Gymnosporangium haraeanum Syd. II. The rôle played by insects in the transfer of spermatia in the fungus.**—*Ann. phytopath. Soc. Japan*, x, 4, pp. 297–303, 1 fig., 1941.

Continuing his studies on the pear rust (*Gymnosporangium haraeanum*) at the Kagosima College of Agriculture and Forestry [*R.A.M.*, xx, p. 477], the writer found that the nectar secreted from the pustules on pear leaves contains reducing sugar and tastes sweetish, but is without perceptible odour. By covering the infected leaves with cheese-cloth and thus preventing the free access of insects to the pustules, the formation of aecidia was reduced to half in field tests compared with the number developing on uncovered foliage. Besides the house fly, *Eristalis cerealis* Fabricius, *Calliphora erythrocephala* Meigen and *Iridomyrmex itoi* Forel were shown to mix the nectars of separate pustules, thereby inducing the formation of the aecidial stage of the rust, while the same species and a number of others [which are enumerated] were observed to visit the pustules on pear leaves in the vicinity of Hukuoka and transfer the spermatia from one pustule to another. Flies were more abundant than ants on the diseased foliage. The duration of the period of secretion of nectar from sterile pustules was longer than that elapsing in the case of fertilized ones.

Leach (R.). **Soil conditions affecting production of perithecia in Banana leaf spot disease.**—*Nature, Lond.*, cli, 3824, p. 199, 1943.

In a few isolated areas of Jamaica perithecia of the banana leaf-spot fungus, *Mycosphaerella musicola* [*R.A.M.*, xx, p. 412], were observed to form in profusion throughout the year, and not only during the limited season from August to January as in most other districts [ibid., xxi, p. 381]. It was found that this abnormal production of perithecia is positively correlated with the growth of the banana on highly acid soils (P_H 4·0 to 4·75 approximately). Normal three-weekly spraying

[loc. cit.] failed to control the disease in these areas at any time of the year. Satisfactory results were obtained only with weekly heart-leaf spraying, but this method is stated to be impracticable once the plants have grown tall. It is considered that spraying may prove generally uneconomic unless liming or some other means are found to ameliorate the effect of high soil acidity. No explanation has as yet been found for this abnormal production of perithecia, although it is thought possible that the water relationship of the soil may play a part in it.

GREGORY (P. H.). **Dissemination of fungus spores in air.**—*Trans. Brit. mycol. Soc.*, xxv, 4, p. 442, 1942.

Investigations on the air transmission of fungus pathogens to new areas are mostly concerned with how far and how high spores are transported by air currents. Comparatively little is recorded of the number of spores deposited within short distances. Under field conditions the relation between degree of infection and distance from an infected field may be important, and from the fact that printed observations on a number of diseases are in agreement with Stepanoff's formula [*R.A.M.*, xv, p. 384] it is thought that dissemination of spores in air may be measured quantitatively.

LARGE (E. C.). **Control of Potato blight (Phytophthora infestans) by spraying with suspensions of metallic copper.**—*Nature, Lond.*, cli, 3820, pp. 80–81, 1943.

In tests with suspensions of metallic copper against potato blight (*Phytophthora infestans*), Arran Banner potatoes at Bude, Cornwall, and Majestic potatoes at Dartington and Kentisbeare, Devon, were sprayed with cuprous oxide and hydrogen-reduced copper, both with added bentonite, Bordeaux mixture also being used for comparative purposes. All the sprays contained 0·25 per cent. copper by weight, and two applications were made, at the rates of 110 and 140 gals. per acre, respectively. Dispersal of the copper particles was secured by trituration of the reduced copper, dry or moist, with a mixture containing 97 parts of bentonite, 2 parts of aluminium sulphate, and 1 part of soda ash, by weight.

In all three areas severe blight was experienced, but the metallic copper sprays, though somewhat less effective than Bordeaux mixture, kept the plants green three weeks after the unsprayed had died, and throughout the experiment gave such good control of leaf infection as to demonstrate quite definitely that metallic copper possesses strong fungicidal powers against *P. infestans*.

The mean total yields of tubers for the three localities, respectively, in tons per acre, were 14·4, 14·3, and 16·1 for the Bordeaux mixture, 15·4, 14·3, and 14·7 for the cuprous oxide plus bentonite, 13·8, 14·6, and 14·3 for the hydrogen-reduced copper plus bentonite, and 10·6, 11·1, and 11·6 for the unsprayed controls.

Plant diseases. Diseases of Potatoes.—*Agric. Gaz. N.S.W.*, lii, 12, pp. 571–578, 581, 22 figs., 1942.

Brief, popular notes are given descriptive of the chief potato diseases present in New South Wales, with hints on their control by seed selection and disinfection with mercuric chloride, and crop rotation; spraying with Bordeaux mixture is a routine practice in some areas where late blight [*Phytophthora infestans*] occurs almost every year. The spotted wilt or 'bronze' disease virus [*R.A.M.*, xxi, p. 244] is spread from diseased to healthy plants by thrips [*Frankliniella insularis*: ibid., x, p. 66]. Brown, dead spots or rings appear on the leaves, and the younger ones may be killed. Infection spreads to the shoot apex, causing blighting and death. The severity of the symptoms depends on the age of the plant at the time of attack. Old leaves may show only zoned, brown spots.

Fawcett (G. L.). **La podredumbre negra de las Papas en Tucumán.** [The black rot of Potatoes in Tucumán.]—*Rev. industr. agríc. Tucumán*, xxxii, 4–6, p. 162, 1942.

The most destructive disease of potatoes in Tucumán is the so-called 'black rot' [late blight] caused by *Phytophthora infestans*, the extension of which in the Province of recent years is probably attributable to the use of infected seed. Under conditions favouring the pathogen, including temperatures ranging from 15° to 20° C., poor soil, and excessive humidity, a stand may be ruined in less than a week from the onset of the disease following a few days' steady rain. Plantings made in February and March are often a failure owing to the ravages of *P. infestans*, encouraged by cold and wet autumn weather, whereas those of July to September, maturing at a relatively dry period, are usually free from infection. Spraying with 0·75 to 1 per cent. Bordeaux mixture is the sole means of control, the first application being made when the plants attain a height of 10 to 15 cm. and the next a week or ten days later, a third treatment being required only if humid conditions develop.

Bailey (H. L.). **Report on the Division of Plant Pest Control.**—*Rep. Vt agric. Exp. Sta., 1941–1942*, pp. 43–51, 1942. [Varityped.]

The following references to potato disease work occur on pp. 48–50 of this report. The first cases of bacterial ring rot [*Corynebacterium sepedonicum*] in Vermont were detected in Essex County in the summer of 1940, other centres being subsequently located in Orleans and Lamoille Counties, as well as in a stored lot. Three of the cases were traced back to a single car-load of seed imported in 1939. In 1941 two further cases, apparently originating from the same source, were observed and a new focus was located in Chittenden County, also from imported seed. The Gram-stain method of determination afforded definite evidence as to the identity of the pathogen.

Black leg [*Erwinia phytophthora*] was more abundant than for many years past, but recent studies have shown this disease to be much less important from the seed-certification angle than was formerly supposed. In the writer's opinion the present tolerances of 2 and 1 per cent. for the first and second inspections, respectively, might well be lifted and the amount of permissible infection left to the inspector's discretion.

On the other hand, the present leaf-roll tolerance is 3 per cent. (first inspection), while that for net necrosis is 5 per cent. and the reduction of both these requires consideration.

Krüger (E.). **Untersuchungen über den Einfluss von Elektrolyten und Nichtelektrolyten auf die Sporangienkeimung und die Differenzierung der Zoosporen bei Phytophthora infestans.** [Studies on the influence of electrolytes and non-electrolytes on the sporangial germination and differentiation of the zoospores in *Phytophthora infestans*.]—*Arb. biol. Anst.* (*Reichsanst.*), *Berl.*, xxiii, pp. 51–95, 1940. [Abs. in *Z. PflKrankh.*, lii, 11, pp. 521–522, 1942.]

Pure water was found to be more effective than any of the organic and inorganic chemical compounds tested by the writer for the differentiation into zoospores of the sporangial plasma of *Phytophthora infestans*. Although copper exerted the strongest inhibitory effect on zoospore formation, other heavy metals, notably iron, were not without influence in this direction and might possibly be used as substitutes for copper. The organic materials used in the trials were less toxic to the zoospores than the metal salts. The efficacy of a given substance increases with its penetrative capacity.

Elmer (O. H.). **Effect of environment on the prevalence of soil-borne Rhizoctonia.**—*Phytopathology*, xxxii, 11, pp. 972–977, 1 graph, 1942.

During an investigation covering a 13-year period (1927 to 1940) on the pre-

valence of soil-borne infection of potatoes by *Rhizoctonia* disease (*Corticium vagum*) [*C. solani*] in Kansas, wide fluctuations were observed, the pathogen being capable of saprophytic survival only in seasons with a sufficient summer rainfall to prevent its desiccation and death in the mycelial stage. Sclerotia were absent during the critical months of July and August, since their production demands cooler conditions than those usually obtaining in the State at that time of year. The incidence of infection reached a maximum of 53·2 per cent. in 1928, when the precipitation in July and August was 2·75 and 4·91 in., respectively, the average daily maximum temperatures 87·8° and 87·6° F., respectively, and the wind, measured as total miles per month, 5,330 and 5,454, respectively, and fell to a minimum of 1·1, 1·1, and 1·3 per cent. in 1935, 1938, and 1939, respectively, when the July and August rainfalls were 0·03 and 3·98, 3·97 and 2·15, and 1·26 and 3·51 in., respectively, the corresponding temperatures 99·7° and 91·6°, 94° and 96·2°, and 99·1° and 89·3°, respectively, and the wind 6,205 and 6,160, 5,610 and 7,299, and 6,759 and 6,198 miles, respectively.

As a parasite, on the other hand, *C. solani* can persist on infected host plants under conditions too dry to admit of its survival saprophytically in the soil, and it was repeatedly observed in the course of these experiments that the amount of *C. solani* in potato field soils was large following an autumn crop of potatoes, vetch, or cowpeas, the two latter being sown as 'fertility' crops in the preceding summer or autumn.

Stevenson (F. J.), Schaal (L. A.), Clark (C. F.), & Akeley (R. V.). **Potato-scab gardens in the United States.**—*Phytopathology*, xxxii, 11, pp. 965–971, 1942.

Highly significant differences in their reactions to the agent of common scab (*Actinomyces scabies*) as regards pustule type and tuber-surface coverage were shown by the 22 potato varieties tested by the authors and their collaborators in four scab gardens in Maine, Colorado, Minnesota, and Michigan in 1939 and 1940 [*R.A.M.*, xviii, p. 340]. The type of pustule, viz., (1) relatively large and deep, (2) relatively large but shallow, (3) small and superficial, and the proportion of tuber surface covered (falling into six classes ranging between 0 to 1 and 81 to 100 per cent.) were closely correlated, indicating that in most cases the comparative responses of the varieties to scab infection could be gauged by either criterion. Generally speaking, the varietal reactions, especially among the more resistant sorts, were quite constant in both years and in the four localities. The interactions between variety and place of cultivation were significant and might have been attributable either to environmental factors or physiologic races of the fungus, or both—probably the former in view of the marked influence of the locality and season on the type of pustule. The deepest pustules, usually considered to indicate susceptibility, were shown by Houma followed by 1037–5, Sebago, and AAO–9 while the shallowest were found on Hindenburg, Richter's Jubel, 256–11, and 528–242. Houma was also the most susceptible of the experimental varieties judging by the extent of the tuber surface covered with scab pustules (mean percentage in 16 tests 50), followed by AAO–9 and Sebago, with 37·5 and 33·8, respectively, while the most resistant were 627–164, Richter's Jubel, and Hindenburg (3·5, 4·7, and 5·3, respectively).

From the results of these trials it seems probable that resistant selections originating in Maine will react similarly to *A. scabies* in other parts of the country, but further tests of longer duration and wider scope are necessary before a final decision on this point can be reached.

Keyworth (W. G.). **Verticillium wilt of Hops.**—*Trans. Brit. mycol. Soc.*, xxv, 4, p. 440, 1942.

The results of detailed studies of the wilt disease of hop (*Verticillium albo-atrum*

and *V. dahliae*), of which altogether 72 outbreaks have so far been reported, have already been noticed from another source [*R.A.M.*, xxii, p. 112].

Discussion on mycological nomenclature, 21 February 1942.—*Trans. Brit. mycol. Soc.*, xxv, 4, pp. 428–439, 1942.

At the meeting of the British Mycological Society in London on 21st February, 1942, the following members took part in a discussion on mycological nomenclature. E. M. Wakefield reviewed the history of nomenclature and explained the application of the present Rules. E. W. Mason entered into the question of obligate and facultative synonyms. G. R. Bisby spoke about the citation of authors and proposed some alteration of the present Rules. J. Ramsbottom concluded the discussion by dwelling on some of the points made by the previous speakers and by stressing the importance of the distinction between taxonomy and nomenclature.

Service and regulatory announcements. List of intercepted plant pests, 1941.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 50 pp., 1942.

In the notes accompanying these lists of the pests and diseases intercepted on plant products entering the United States from 1st July, 1940, to 30th June, 1941 [*R.A.M.*, xxi, p. 352] attention is drawn to the fact that *Bacterium* [*Xanthomonas*] *citri* [ibid., xx, p. 531] was intercepted on lime (*Citrus aurantifolia*) from the Dutch East Indies, Java, and the Philippines, on grapefruit from China, and on orange from China and Japan. *Elsinoe australis* [ibid., xxi, p. 369] occurred occasionally in citrus from Argentina and Brazil. Black spot (*Phoma citricarpa*) [ibid., xvi, p. 601] was found on citrus fruit from South Africa, where the disease is now established. Lima bean [*Phaseolus lunatus*] scab (*E. phaseoli*), so common on shipments from Cuba that it is listed among the common diseases [ibid., xx, p. 336], was seen more or less frequently. *Helminthosporium allii* [ibid., iv, p. 325], which occurs as dark mycelium and spores, especially on garlic from Mexico, also occurred so often that it is listed as a common disease. An organism new to these lists is *Dendrochium lycopersici*, hitherto known from Belgium, but now recorded on tomatoes from Mexico. One or more of the oriental strains of the *Lespedeza* rust (*Uromyces lespedezae-procumbentis*) [ibid., xiv, p. 516] were again intercepted with seed from Japan. Dutch elm disease (*Ceratostomella ulmi*) was again found on several lots of elm crating from England. A new disease, tentatively identified as due to *Sclerotinia kerneri*, a fir pathogen described from Austria and not known to occur in North America [cf. ibid., xxi, p. 355], was found on Christmas trees (*Abies balsamea*) from Newfoundland and on 'greens' (*Abies* sp.) from Nova Scotia. Other diseases listed are *Claviceps paspali* on *Paspalum* sp. from the Canal Zone and Costa Rica, potato spindle tuber from Peru, and tomato spotted wilt on tomatoes from Cuba and Mexico.

Thompson (Maude A.). **Cumulative index to service and regulatory announcements Nos. 1 to 149 inclusive, 1919–41.**—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 89 pp., 1942.

In response to the demand of administrative officers and inspectors for a complete cumulative index to the service and regulatory announcements published by the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, first at monthly and subsequently at quarterly intervals since 1914, the present compilation supplements the first 20-year index prepared by H. S. Dean in 1934 with material covering the period from 1934 to 1941, inclusive. Among the features of the work facilitating its consultation for purposes of reference may be mentioned the separate lists of each quarantine, with all title changes, revisions, amendments, and relevant administrative instructions, together with their effective dates.